Issued December 20, 1915.

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF SOILS—MILTON WHITNEY, Chief.

IN COOPERATION WITH THE WISCONSIN GEOLOGICAL AND NATURAL HISTORY SURVEY, E. A. BIRGE, DIRECTOR; COLLEGE OF AGRICULTURE, UNIVERSITY OF WISCONSIN, H. L. RUSSELL, DEAN; A. R. WHITSON, IN CHARGE SOIL SURVEY.

SOIL SURVEY OF DANE COUNTY, WISCONSIN.

BY

W. J. GEIB AND ARTHUR E. TAYLOR, OF THE U. S. DEPARTMENT OF AGRICULTURE, AND GUY CONREY, OF THE WISCONSIN GEOLOGICAL AND NATURAL HISTORY SURVEY.

W. E. McLENDON, INSPECTOR, NORTHERN DIVISION.

[Advance Sheets—Field Operations of the Bureau of Soils, 1913.]

WASHINGTON:
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1915.

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS,
Washington, D. C., June 5, 1915.

SIR: Under the cooperative agreement with the State of Wisconsin a soil survey of Dane County was carried to completion during the field season of 1913.

I have the honor to transmit herewith the manuscript and map covering this work and to recommend their publication as advance sheets of Field Operations of the Bureau of Soils for 1913, as authorized by law.

Respectfully,

MILTON WHITNEY,
Chief of Bureau.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

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SOIL SURVEY OF DANE COUNTY, WISCONSIN.

By W. J. GEIB and ARTHUR E. TAYLOR, of the United States Department of Agriculture, and GUY CONREY, of the Wisconsin Geological and Natural History Survey.

DESCRIPTION OF THE AREA.

Dane County is located in the southern part of Wisconsin, about midway between the Mississippi River and Lake Michigan. It is bounded on the north by Columbia County and by the Wisconsin River, which separates the northwestern corner from Sauk County, on the east by Dodge and Jefferson Counties, on the south by Rock and Green Counties, and on the west by Iowa County. The county is rectangular in shape, with one corner cut off by the Wisconsin River. It has an extreme length east and west of 40 miles, and a width north and south of 30 miles. It comprises a total area of 1,202 square miles, or 769,280 acres.[1]

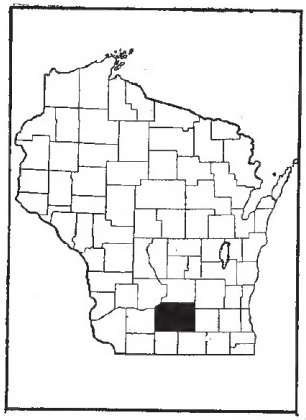


FIG. 1.—Sketch map showing location of the Dane County area, Wisconsin.

Topographically the eastern part of Dane County presents a striking contrast to the western part. It is not one of wide difference in strength of relief, but one of difference between two kinds of relief, both of relatively faint expression. The features of the eastern part of the county are strikingly rounded in all their main outlines, while those of the western part are strikingly angular. Both the roundness of the eastern features and the angularity of the western are more pronounced than is the case in most landscapes. The differences are important not merely because of their effect on the appearance of the landscape, but because of profound influence on the agriculture. In the eastern part of the county there is practically no land too steep for cultivation, while in the western part there are considerable areas that are too steep. The

[1] The base map used in the soil survey of Dane County was made up for the most part of topographic sheets of the U. S. Geological Survey. Small portions showing no contours are based upon plane-table traverse by the soil men. Where the topographic sheets join some discrepancies exist in the contour lines. No attempt has been made to adjust these differences.

transition from one type of surface to the other is somewhat gradual, taking place in a slightly northeast-southwest belt lying between the meridians of Madison and Middleton.

In its fundamental physiographic features the county consists of two plains, a lower one and a higher one. Neither is perfectly developed, or has at any place an extensive area free from interruptions of other topographic features. The lower plain is thickly dotted with hills standing on its surface, so much so that at no place is there an area of uninterrupted smooth plain of more than 2 or 3 square miles. The lower plain is best developed in the eastern part of the county, though the rather broad valleys in certain parts of the western half of the county are continuous with it and may be considered as westward extensions of it in a topographic sense, though this is not true of their geological relationships. The surface of the plain east of Middleton is smooth to undulating, large areas of it being poorly drained, and a very considerable part of it consisting of swamp. The western extensions mentioned are mainly long, narrow strips.

The interruptions of the surface of this plain consist in the eastern part of the county almost exclusively of low, rounded, elongated hills, all with their longer axes parallel and all having essentially the same shape, though they vary in size. Their average length is less than a mile, their width a quarter mile or less, and their maximum height above the plain about 75 feet. Where a considerable number stand in a group their coalescing lower slopes build a kind of platform for the support of the main part of the hills. In the extreme eastern part of the county they stand apart mainly as single hills or at most with only a few in a group. Westward the groups become numerous and much larger, and their platforms become higher at the expense of the individual hills of the group, though these still retain their rounded outline and elliptical shape in ground plan. This tendency increases westward to the neighborhood of the longitude of Middleton, where the rounded hills cease to exist, the platforms on which they stood having risen to the level of the hilltops farther east or higher and soon coalescing to form the higher plain referred to above.

The higher plain lies in the western part of the county, the largest area of smooth and nearly unbroken plain lying in a strip a mile or so wide running westward from Mount Horeb to Blue Mounds. At the latter place its surface is interrupted by a hill standing on it and rising 400 feet above its surface. Both to the north and to the south of this smooth belt the plain becomes thoroughly and rather deeply dissected by a network of drainage lines. The valleys of the permanent streams are broad when compared to the size of the

existing streams and even the valleys of small intermittent streams, scarcely more than temporary storm channels, are wide, taking the form of imperfectly developed and narrow coves. As stated above, these valleys are continuous with the lower plain of the eastern part of the county.

The upland belts between the streams and ravines are reduced to narrow, branching watershed ridges. They are of even height, as a rule, and have very steep upper slopes and more gradual lower ones. Along the belt where this type of topography merges into that of the eastern half of the county there are many isolated hills standing on what is a westward continuation of the lower plain, but the hills are steep-sided and flat-topped, typically mesalike in their form, and irregular in outline and ground plan rather than elliptical. Many of the smooth, imperfectly rounded, and imperfectly elliptical hills in the longitudinal belt of Madison and a few miles west seem to be nothing more than former isolated hills like those just described which have been rendered less angular in shape, partly by erosion of their sharp angles and partly by the deposition of material at other places. In the extreme eastern part of the county this is not the case, the hills there having been built entirely, according to the evidence presented by their exterior form and interior geological constitution, from the level of the plain on which they stand, of soft or unconsolidated material.

The topography of the eastern part of the county is constructional, that of the western part destructional. The former was built by the glacial ice during the Wisconsin stage of the glacial period, and although the ice disappeared long before the advent of man, yet from the geological point of view glaciation took place recently—so recently that streams have not yet been able to make any marked progress in eroding the country. The surface configuration is practically as the ice shaped it. The western half of the county, on the other hand, was never covered by ice. Its surface has been exposed to the eroding action of streams, not only since the glacial period, but for a very long time before. Its relief is due to their vigorous work. The hills in this part of the county are hills of erosion; that is, they stand out because of the erosion of material from between or around them. The hills in the eastern part of the county, on the other hand, have in most cases been built up by the ice. The smooth, rounded, elongated, and larger ones are known as drumlins and are supposed to have been built up beneath the ice, while many smaller ones, associated with "kettles" or small inclosed basins, are supposed to have been built up at the ice front. Such hills and their associated depressions are known as moraines. Some of the hills along the central north-south belt of the county seem to have existed

before the invasion by the ice and were overridden, rounded, and smoothed out in their outline by its action.

The most important, as well as the most striking, fact about the natural drainage of Dane County is its imperfect development in the eastern and its perfect development in the western part of the county. This is brought out by the drainage ways shown on the soil map accompanying this report. It will be noticed that in the eastern part the drainage waters have few channels for their outlet, while in the western they are very abundant. A corollary to this is the large area of swamp in the eastern part and its nearly complete absence in the western. This contrast is not one of different drainage basins, since the main Rock–Wisconsin watershed runs across the county from Blue Mounds northeastward to the northern boundary due north of Madison, while the line between the well-developed drainage systems of the western part of the county and the imperfectly developed drainage of the eastern runs nearly due north and south across the main watershed.

The first white men to enter this general region were hunters and trappers, who reached the country by way of "The Portage" and the Wisconsin River. The first permanent settlers were lead miners. About 1830 homeseekers came in to take up land for farming purposes. The first settlers of this class were largely from Illinois, Ohio, and the New England States. Following these there was a great influx of Germans and Norwegians, and at present the population is made up largely of people of foreign extraction, including Germans, Norwegians, Irish, English, and a number of other nationalities. The county was set off from parts of Iowa and Milwaukee Counties in 1836, but was not organized as a separate county until 1839. The population of Dane County is reported in the 1910 census as 77,435, and is quite evenly distributed.

Madison, the capital of the State, is the county seat of Dane County. Its population is given as 25,531 in the 1910 census. Madison is a railroad and manufacturing center of considerable importance. The University of Wisconsin and the Agricultural Experiment Station are located here. Stoughton, with a population of 4,761, is the second city in size. It has extensive wagon-manufacturing interests, and is the center of a highly developed farming section. Other towns and villages of importance are Sun Prairie, Mount Horeb, Mazomanie, Middleton, Marshall, Waunakee, De Forest, Belleville, Cross Plains, Dane, Verona, Blue Mounds, Morrisonville, Windsor, Cottage Grove, Macfarland, London, Klevenville, Riley, Basco, and Burke.

Dane County is exceptionally well provided with transportation facilities. Lines of three railroad systems serve the county, radiating in all directions from Madison. The main line of the Chicago &

North Western Railway crosses the county from northwest to southeast. From Madison one branch of this line extends west along the "Military Ridge" and another branch extends east to Milwaukee. A line of the Chicago, Milwaukee & St. Paul Railway crosses the county from east to west and joins the main line at Watertown, Jefferson County. From Mazomanie a branch runs north to Sauk City and Prairie du Sac. Another line runs north from Madison to Portage and another southeast from Madison to Chicago. A branch of the Illinois Central Railroad extends from Freeport, Ill., to Madison.

The towns within the county provide a ready market for farm products and are shipping points from which large quantities of produce are sent to outside markets. Most of the stock goes to Chicago, though some is shipped to Milwaukee. The Lake cities constitute good markets for all products of the farm, dairy, and garden.

The wagon roads throughout the county are, as a whole, in good condition, and each year large sums are expended in road improvement. Through the assistance of the State, roads made of crushed rock are being constructed in various parts of the county. All parts of the county are supplied with the rural delivery of mail and telephones are in common use.

CLIMATE.[1]

Among the factors which influence the agriculture of a State none is more important than the climate. The class of crops which can be grown is largely determined by the length of the growing season and the amount and distribution of the rainfall, so that the climate may determine the type of agriculture which can be practiced to best advantage.

The distribution of rainfall over Wisconsin is remarkably uniform, the average yearly precipitation ranging from 28 to 34 inches, while the mean for the State as a whole is 31 inches. This is a slightly heavier rainfall than is received by eastern England, northern France, most of Germany and Sweden, and the Danube Valley. As compared with other sections of this country, Wisconsin has a total rainfall equal to that of central Oklahoma and Kansas, northern Iowa, Michigan, northwestern New York, or the Puget Sound Basin of Washington. Owing to its northern location, however, the lessened evaporation probably makes the precipitation as effective as that of Arkansas, Illinois, or Virginia.

The local distribution of rainfall varies, however, from year to year, the variation being caused by the movement of cyclonic storms.

[1] This chapter has been taken largely from Bul. No. 223, Wisconsin Agr. Expt. Sta., "The Climate of Wisconsin and its Relation to Agriculture."

Since authentic records have been kept the average rainfall for the State during the driest year was 21.4 inches and during the wettest year 37 inches. For Dane County the total precipitation for the driest year recorded was 13.49 inches and for the wettest year 52.91 inches. The mean annual precipitation is 31.25 inches.

Of equal importance in agriculture to the total amount of rainfall is its seasonal distribution, and in this respect Wisconsin is favorably situated, since about half of the total rainfall occurs in May, June, July, and August, and nearly 70 per cent from April to September, inclusive. The rainfall is heaviest in June, averaging 4.01 inches, while in July it averages 3.8 inches and in May 3.66 inches. The precipitation during the winter, on the other hand, is slight, December, January, and February each averaging somewhat over 1.5 inches. The average rainfall for the State during the winter is 3.9 inches, during spring 8.3 inches, summer 11.4 inches, and fall 7.4 inches. For Dane County it is 4.85 inches during the winter, 8.28 inches during the spring, 10.96 inches for the summer months, and 7.16 inches for the fall. Most of the rainfall occurs just preceding and during the period of plant growth; thus, the growing season—April to September, inclusive—has an average of 20.24 inches, which is as much rain as is received during the same months by eastern Texas, Illinois, Ohio, or eastern New York. Owing to the small winter precipitation, on the other hand, there is practically no leaching of fertility from the soil or erosion.

Another phase of rainfall distribution of great importance is its variation within a period of a few weeks. Frequently periods of drought and periods of unusually heavy rainfall occur, continuing for 1 week to 4 weeks and occasionally longer. Observations taken at Madison over a period of 30 years, from 1882 to 1911, inclusive, show that there are on the average three 10-day periods during each growing season when the amount of rainfall is so slight that crops on a moderately heavy soil, such as the Miami silt loam, actually suffer from lack of moisture.

The eastern and southeastern sections of Dane County are included within the Rock River Basin, which is one of the eight climatic provinces in Wisconsin. This section has the longest growing season of any in the State, averaging about 170 days, which is as long as that of central Illinois, longer than that of central Indiana or Ohio, and about equal to that of the Valley of Virginia and that of central Maryland. The mean annual temperature in Dane County is 45.7° F. The winters here are cooler than along the Lake, and the springs and summers are warmer. This section is the best corn area in the State. The temperature of the Rock River Basin in summer is similar to that of northern Illinois, Indiana, Ohio, and southwestern Pennsylvania, while in winter it is comparable with that of southern

Vermont, northern Iowa, and southern Montana. On seven summer days on the average each year the thermometer may go as high as 90° and during five winter mornings on an average it may fall to 10° below zero or lower. The highest temperature recorded in the county is 104° F., and the lowest —29° F. Such extremes are of rare occurrence and of short duration. The southwestern and a part of the western sections of Dane County have a somewhat shorter growing season, and are included in what is known as the Southern Highlands. The average elevation is somewhat greater than that of the eastern and southeastern parts of the county and the growing season ranges from 10 to 20 days shorter.

The average date of the last killing frost in the spring is April 22; the latest date of killing frost recorded is May 13. The average date of the first killing frost in the fall is October 18, while the earliest date recorded is September 29.

The following table gives the normal monthly, seasonal, and annual temperature and precipitation as recorded by the Weather Bureau station at Madison:

Normal monthly, seasonal, and annual temperature and precipitation at Madison.

Month.	Temperature.			Precipitation.		
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year.	Total amount for the wettest year.
	°F.	°F.	°F.	Inches.	Inches.	Inches.
December	22.8	60	−28	1.72	1.80	1.32
January	16.9	58	−29	1.63	1.12	2.05
February	18.7	63	−28	1.50	0.26	5.42
Winter	19.5			4.85	3.18	8.79
March	30.4	86	−12	2.08	0.27	4.34
April	45.6	86	8	2.54	1.06	1.50
May	57.6	90	23	3.66	2.58	4.25
Spring	44.5			8.28	3.91	10.09
June	67.3	98	38	4.01	0.59	4.15
July	72.0	104	48	3.80	1.21	9.47
August	69.8	96	46	3.15	2.08	0.56
Summer	69.7			10.96	3.88	14.18
September	62.3	93	29	3.08	0.91	8.17
October	50.0	84	12	2.32	0.58	9.12
November	35.1	69	−14	1.76	1.03	2.56
Fall	49.1			7.16	2.52	19.85
Year	45.7	104	−29	31.25	13.49	52.91

AGRICULTURE.

Agriculture was first practiced in Dane County about 1830. The first settlers selected the rolling timberland because of the ease of obtaining wood and water, and also on account of the protection from the winter weather. Settlers from Ohio and Illinois who were accustomed to farming on prairie land located more often along the edge of the prairies, and as the population increased the prairie lands were gradually taken up.

The early agriculture consisted mainly of grain production, with the growing of enough garden and truck crops to supply the needs of the family. For many years the grains, including wheat, oats, barley, rye, and flax, were by far the most important crops grown, and of these wheat was much the most important. For a number of years it exceeded all other crops combined. Wheat was in many cases grown in the same field for a long period of years. At first the virgin soil produced excellent yields, but the continued cropping, together with the ravages of the chinch bug, so reduced the yields that the crop could not be produced with profit. Grain production gradually gave way to a more diversified system of farming. Corn and oats proved to be profitable, and the raising and feeding of stock gradually developed into an important dairy industry. Tobacco was introduced into Dane County by settlers from Ohio as early as 1853, and was grown on the "prairies" in the southeastern section. From this beginning tobacco developed into an important crop. It is still grown extensively, mainly by Norwegians, in the southeastern part of the county.

The type of agriculture most extensively followed in Dane County at the present time consists of general farming in conjunction with dairying. A number of special crops receive attention, and among these tobacco is by far the most important. Peas, sugar beets, and potatoes are grown. The general farm crops are corn, oats, barley, rye, wheat, buckwheat, timothy, clover, and alfalfa.

Corn is grown more extensively than any of the other cultivated crops. In 1909, according to the census, 107,182 acres were devoted to corn, with a production of 3,501,937 bushels. White and yellow dent varieties are the most popular. The corn is usually cut with a harvester and husked from the shock, the stover being stacked in the field or shredded and stored in the barn for coarse winter feed. In recent years many silos have been built and a large part of the corn is now used for ensilage.

Oats are second in importance to corn. The census of 1910 reports 99,968 acres in oats in the county, with a production of 3,157,306 bushels. Practically the entire crop is used for feed on the farms, comparatively little being placed on the market. The Miami silt

loam and the better areas of the Union silt loam produce oats of the highest quality, though the Carrington silt loam and other black prairie types often give larger yields per acre.

Barley is an important crop in many sections. With a number of farmers it is the chief cash crop grown. In 1909 there were 34,873 acres in barley, producing a total of 910,388 bushels. The acreage devoted to this crop has been gradually decreasing, chiefly because of a reduction in the yields obtained. The barley is grown almost entirely on the heavy soils of the county.

Rye is not grown extensively, but in some parts of the county it is an important crop. From 3,247 acres in 1909 a total volume of 46,003 bushels was harvested. The growing of rye is confined almost entirely to the sandy types of soil. It is planted as a grain crop, for green manuring, and for pasturage. On the sandy loam types very satisfactory yields are usual, and during years of at least normal rainfall good crops are often obtained on some of the more sandy types.

The acreage devoted to wheat, which was at one time the most important crop in the county, is at present small. The 1910 census reports 2,522 acres in wheat, with a production of 48,595 bushels. Although the average yields are low, where grown in a good crop rotation wheat usually gives very satisfactory yields.

Buckwheat is grown to a very small extent and is confined largely to the low sandy soils of the county. In 1909, 225 acres in the county were devoted to buckwheat, producing 4,218 bushels.

Of the hay crops grown in Dane County timothy and clover are the most important. It is the common practice to sow these together, with some small grain as a nurse crop. The medium red is the most popular clover grown. Some difficulty has been experienced in getting a good stand of clover during recent years, owing to winter-killing in the late winter, when the ground is alternately freezing and thawing. On certain types of soil an acid condition exists, which is detrimental to best results with leguminous plants, including clover. On the heavier soils and where drainage is somewhat deficient alsike is being grown to a considerable extent, as a stand can usually be obtained more easily than with the medium red clover. Mammoth clover does well on the lighter soils, but on the heavy types it is coarse and not so satisfactory as the medium red. Both timothy and clover are sometimes seeded alone and cut for seed as well as for hay. Over the low, marshy tracts within the county many tons of marsh hay are cut each year, but this is of inferior quality.

Alfalfa is becoming a very important crop, especially in the dairy districts. Three cuttings can always be counted on, and the average yield per acre is 3 tons per year. Alfalfa can be grown on many of the different soil types in the county when the soil is put in proper

condition. A good stand is always gotten where the field is inoculated, well supplied with stable manure, and in a sweet condition. It is a good practice to sow a small quantity of alfalfa seed with clover and timothy so as to get the field inoculated for the alfalfa crop.

The acreage of emmer and spelt grown in Dane County in 1909 was small. A total of 226 acres produced 7,875 bushels.

In addition to the general farm crops, several others which may be classed as special crops are produced, and among these the most important are tobacco, potatoes, sugar beets, and peas.

Dane County holds first place in Wisconsin in the production of tobacco. In 1909, of a total acreage of 40,458 acres devoted to this leaf within the State, 16,789 acres were in Dane County, and the output for the county is reported as 20,932,967 pounds. Almost one-half of this was produced in the four southeastern townships of the county. Stoughton, in Dane County, and Edgerton, just across the line in Rock County, are approximately in the center of Wisconsin's tobacco-growing section. Most of the tobacco grown is of the Comstock's Spanish variety. About 85 per cent is sold as binder tobacco, and the remainder, consisting chiefly of broken leaves and stems, as filler. Binder tobacco sells for 7 to 14 cents a pound, and filler for about 2 cents a pound. The average yield is about 1,200 pounds per acre. The custom of contracting for the crop in the field, to be delivered after curing, was discontinued after 1912, and at present the crop is contracted for in the shed. Tobacco is grown most extensively on the Carrington and the Miami silt loams. The choicest land for tobacco appears to be near areas of Carrington fine sandy loam where there is just a little sand mixed with the silt. The crop is fertilized with stable manure, very little commercial fertilizer being used. In order to maintain the productiveness of the tobacco land and provide a very rich soil, 20 to 40 loads of manure are applied per acre. As about 10 acres of tobacco are grown on the average by each of the planters in the tobacco section, it takes all of the manure produced on the farm to supply this one field, and as a result the remainder of the farm can not be manured. Tobacco is grown to a large extent by small farmers or by tenants.

Potatoes, while not an important crop commercially, are grown quite generally in small fields in the sandy sections of the county, and in all parts the tuber is grown to a sufficient extent to supply home needs. The 1910 census reports 5,883 acres in potatoes in 1909, with a production of 679,675 bushels. The Early Rose, Early Ohio, Rural New Yorker, and Peerless are among the varieties most commonly grown.

Sugar beets are grown quite extensively on some of the heavier types of soil, chiefly the Carrington silt loam and Miami silt loam.

In 1909, from 1,247 acres, a production of 14,060 tons is reported. A beet-sugar factory is located at Madison, and a large percentage of the beet tonnage is shipped to this point. It is customary for the farmers to put in the crop and attend to the implement cultivation, while the factory furnishes labor to do the hand work, such as thinning, weeding, and topping, for which a charge of $20 per acre is made. Yields range from 8 to 18 tons per acre, and the usual selling price f. o. b. is $5.50 to $6 per ton, depending upon the sugar content. The sugar content of beets grown on the Miami silt loam is a little higher than that of those grown on the Carrington silt loam or other dark-colored soils, but the yield is usually higher on the dark soils, and the net returns usually a little larger than from the light-colored types.

Peas for canning and also for seed are grown quite extensively in the northeastern part of the county and to a small extent in the northwestern section. One canning factory is located within the county, at Sun Prairie. A large factory is operated at Columbus, which is but a few miles distant from the northeastern corner of the county. Another factory is located at Sauk City, a few miles from the northwestern corner of the county. Yields range from 2,000 to 2,200 pounds per acre of shelled peas for canning, for which the farmers receive 2 to 2½ cents per pound. In order to obviate long hauls viners are located throughout the pea-growing sections, making possible the extension of the industry beyond the immediate vicinity of the canning factory. In sections too far removed from factory and viners seed peas are grown. The usual yields range from 15 to 20 bushels per acre, and the price varies from $1.50 to $2 per bushel. The varieties chiefly grown are the Alaska, a very early pea, and the Advance, Admiral, and Horsford, which are later. Peas are proving to be profitable, and, being a legume, they tend to build up the soil in the same way as alfalfa, though probably not to so great an extent. The Miami silt loam has been found especially suited to peas. They also do well on the Carrington silt loam, but the quality is not quite so high as of those grown on the Miami silt loam.

The growing of truck crops on a commercial scale has been developed in the immediate vicinity of Madison, where most of the common vegetables are grown for the city market. Some of the sandy types of the county are very well adapted to the trucking industry. Nearly every farm has a garden in which most of the common vegetables are grown for home use, but there are only a few places in the vicinity of towns where trucking is engaged in on a commercial scale.

The fruit industry has not been developed commercially, except in a few orchards, chiefly in the vicinity of Madison, where small fruits

and berries, such as raspberries, blackberries, currants, and strawberries, are grown. Apples are grown in small orchards on many of the farms, but there are no large commercial orchards within the county. There are a large number of excellent orchard sites, especially in the western and southwestern parts of the county, where the soils are favorable for apple culture, and it would seem that apple growing could be profitably developed on a commercial scale.

Considered from the standpoint of returns, dairying is the most important industry in Dane County. In 1913 there were within the county 90 cheese factories, 50 creameries, and 4 skimming stations, and a large condensery is located at Middleton. There are a number of purebred dairy herds in the county. The Holstein is more numerous than any other breed, followed by the Guernsey and Jersey. By far the greater part of the dairy stock, however, is made up of grade stock, with Holstein and Shorthorn blood predominating. Many dairy herds are headed by purebred sires, so that the stock is gradually being improved.

In the western and southwestern sections of the county, where the surface is quite rough and broken, and where corn can not be grown as profitably as in other sections, mainly on account of the danger from erosion on the steep slopes, farming conditions are somewhat different from those in sections where the topography will permit the extensive growing of all intertilled crops. On account of the smaller acreage of corn in the southwestern section, hog raising is rather restricted, and less use can be made of skimmed milk than in other sections. It is therefore recognized that the dairy product can be more profitably disposed of in the form of cheese than as butter. Consequently there are many cheese factories in that section and only a few creameries. In other sections of the county creameries are more numerous, corn is grown more extensively, and hog raising is a more important branch of agriculture.

In the production of beef cattle Dane County ranks first in the State. Throughout the tobacco-growing section, where dairying is of little importance, it is a common practice to fatten cattle each year in conjunction with the general farming operations which are carried on by the tobacco growers. In other parts of the county the feeding of beef cattle is a minor activity. While there are a few purebred herds of most of the leading beef breeds, a large part of the stock is of mixed breeding, usually with Shorthorn blood predominating.

Horses are raised on many farms, but seldom as the main product. Most farmers raise their own work stock, and frequently horses are sold. The quality of the sires used is gradually being improved, with the result that larger and better work horses are taking the place of the smaller stock.

Sheep are raised only to a comparatively small extent. It is a fact that sheep are not raised as extensively in the rougher portions of the county, where there is a large acreage of grazing land, as in the sections where land values are higher and where the soil is well adapted to a large variety of cultivated crops. There are several flocks of purebred sheep, but the total number of sheep in the county is small.

Hog raising is carried on quite extensively in all parts of the county except the southwestern section, where cheese production is important. Hogs are most numerous in sections where butter is the chief dairy product. With the high price of pork that has prevailed for a number of years, hog raising is proving very profitable where the herds can be kept free from disease. Severe losses are sometimes caused by hog cholera. The Poland China, Duroc-Jersey, Berkshire, and Chester White are the leading breeds.

Farmers are beginning to realize the value of the adaptation of crops to soils. It is generally recognized that certain crops produce higher yields and are of better quality on certain soils than on others. Peas, for instance, appear to do best on the Miami silt loam. Corn makes its best growth on the dark-colored soils, such as the Carrington silt loam, Dodgeville silt loam, and Waukesha silt loam. On these dark soils, having a large percentage of organic matter, small grains are likely to lodge and the quality of the grain is not so good as on the light-colored heavy soils of the county. The grasses appear to do best on the dark-colored soils of heavy texture. Potatoes of the best quality are grown on the sandy and sandy loam types. Local conditions, however, often are such as to make it impossible to conform strictly to the growing of crops best adapted to a given soil.

The necessity of changing crops from year to year on any field is recognized, although in many cases systematic crop rotations are not carried out. A rotation quite common for the light-colored, heavy-textured soils of the county consists of corn one year, followed by oats, and then barley, or wheat seeded with timothy and clover. Hay is usually cut for two years before the field is again plowed for corn. On the prairie soils corn is quite often grown two years in succession, and followed by grain and hay crops. In those sections of the county where erosion is an important factor and but little corn is grown, the rotation is often grain for two years, followed by clover and timothy two or more years. Throughout the county most of the farmers plan to seed the land to grasses at least once every four or five years. In the tobacco-growing districts, however, conditions are different. Tobacco has often been grown in the same field for 5 to 10 years, and in some instances for 15 years. A field once heavily fertilized and put into condition for tobacco becomes the

richest field on the farm, and it is easier to use this field year after year than to change the crop. The necessity of shortening the period of use of any one field for tobacco is being more generally recognized. The experience of the tobacco planters indicates that to obtain best results tobacco should not be grown on the same field longer than 3 to 5 years. The common practice is to follow tobacco with corn for 1 year or 2 years, and seed the field down for several years before putting it in tobacco again.

Increasing attention is being given to better methods of cultivation. The walking cultivator has been largely displaced by the large riding cultivator for use in the corn fields. In growing tobacco a part of the work originally done with the hoe is now being done with horse cultivators. In the fertilization of the soil manure-spreaders are coming into common use. The tendency throughout the county is toward following better and improved methods of cultivation, fertilization, and seed selection, and as a result of this advance in scientific farming crop yields are being increased and agriculture is coming to occupy a higher plane.

The most troublesome weeds in Dane County probably are the Canada thistle, quack grass, wild mustard, and wild morning glory. The amount of damage caused by such pests is not fully appreciated, and there is a general need of additional efforts toward their eradication.

The farm buildings throughout the county, as a rule, are well constructed, substantial, and kept in good repair. The silo forms a part of the equipment of most of the dairy farms. The fields are generally well fenced, and woven wire is coming into common use.

Windmills are quite common, though on many farms gasoline engines are used for pumping water and running various kinds of the lighter machinery. In general the appearance of the farmsteads indicates thrifty and prosperous agricultural conditions.

The supply of hired help for the farms is usually limited. The members of the family do most of the farm work. Farm laborers are usually paid $30 to $40 per month with board. During haying and harvesting, day laborers are paid $1.50 to $2, and sometimes as much as $2.50. During the season of 1913 tobacco laborers, hoeing and harvesting the crop, received $3 and $3.50 a day.

The census of 1910 reports a total of 6,058 farms in Dane County, comprising 95.7 per cent of its area. Of these farms 73.2 per cent are operated by the owners, the remainder being divided in the ratio of about 3 to 2 between share and cash tenants. The average size of the farms is 122 acres, of which on an average 88 acres is improved.

The value of farm land varies widely with the different types of soil. The highest priced land in the county is in the tobacco-growing section, where small farms of choice tobacco land are held at $200

to $250 an acre, and some at even a higher figure. Larger farms on the Carrington silt loam and Miami silt loam are valued at $125 to $150 an acre. On the other hand, some of the farms on the sand types are held at $25 to $40 an acre. In the driftless region land values depend on the percentage of rough, steep land included in a farm, and the prices range from $40 to about $125 an acre. Location, character of soil, and improvements are factors which determine the value of farm land. The average value of land in Dane County was reported in the 1900 census as $41.20 an acre. In 1910 the average value is given as $72.73.

Although the agriculture of Dane County is in a comparatively high state of development, there are certain lines along which improvement is needed. One great deficiency of all the light-colored soils of the county is organic matter. This is effectively supplied by supplementing the stable manure with green-manuring crops, of which the legumes are the best. By increasing the supply of organic matter, not only is plant food added but the water-holding capacity of the soil is increased and the structure of the heavy soils is improved. Litmus tests made during the progress of the survey indicate that an acid condition exists in some of the types. This condition can be corrected by the application of ground limestone or some other form of lime. Before alfalfa can be grown successfully the soil should be in a sweet condition and inoculated. There is a general need for greater attention to the systematic rotation of crops in order to secure combinations best suited to soil conditions on the farm. More thorough methods of cultivation, especially of intertilled crops, are needed. Thorough cultivation helps to conserve soil moisture. As a rule the selection of seed does not receive proper attention.

With certain special crops, such as tobacco and sugar beets, commercial fertilizers, properly tested, are valuable as a supplement to stable manure, of which the supply is usually inadequate. The growing of alfalfa and of other legumes, such as peas and beans, is beneficial to the soil and could be profitably extended.

The drainage of wet lands affords an extensive field for development. Aside from the large marshes, there are on many farms small patches of wet land which could be tiled at little expense, materially increasing the productive area of the farms. Many areas of Peat, with proper drainage, are capable of producing profitable crops. Land values are so high as to encourage the reclamation of nonproducing tracts.

SOILS.

Dane County includes several distinct geologic formations, and all of these have contributed to a greater or less degree to the material from which the various soil types have been derived. The

oldest formation within the area is the Potsdam sandstone, which forms the surface rock in the valley of the Wisconsin River and in parts of the valleys of tributary streams in Dane, Berry, Roxbury, and Cross Plains Townships. It also forms the surface rock over a part of the Catfish or Yahara Valley, but in this instance the formation is represented only by the uppermost layers, which are known as the Mendota and Madison beds.

Over the Potsdam sandstone is found the Lower Magnesian limestone, which forms the surface rock over the principal divide between the Wisconsin River and its tributaries on the west and the Yahara and Sugar Rivers on the east. Outcrops of this rock occur frequently along the valley walls of these streams and their tributaries. It is also the surface rock over most of the eastern half of the county.

Immediately over the Lower Magnesian limestone is the St. Peters sandstone, which outcrops frequently along the steep valley walls throughout the western and southwestern sections of the county, and also occurs in scattered areas in the eastern part.

The Trenton and Galena limestones constitute the surface rock in the elevated ridges between Blue Mounds and Mount Horeb, and south to the Green County line.

A large part of the county has been modified by glacial action. The glaciated section may be roughly separated from the unglaciated region by a line extending from the northwestern corner of the county to a point just west of Cross Plains, thence to a point three-fourths mile west of Verona, and on to a point about 1½ miles east of Belleville. The glaciated region lies to the east of this line. Within a crudely formed triangle, with the towns of Verona, Belleville, and Brooklyn at the angles, there occurs a formation representing the pre-Wisconsin stage of glaciation. This is of such an age and has been weathered to such an extent that the region has more the appearance of a residual than a glaciated surface. The remainder of the glaciated portion of the county is covered by material deposited by the late Wisconsin ice sheet, and from this formation many of the soils of the county have been derived.

The soils of Dane County have been grouped into 14 series and 31 types, including Rough stony land, Madeland, Peat, Muck, and Meadow.

The Miami series is one of the most important, both in extent and agricultural value. It includes all the light-colored forested upland where the soils have been derived from unassorted glacial limestone till.

The Carrington series is also important in this county. The Miami and Carrington series include a large part of the best agricultural land in Dane County. The Carrington series comprises all

the dark-colored prairie upland soils which are derived from the weathering of unassorted glacial limestone till.

The light-colored, waterlaid, forested soils of the glaciated limestone region are classed with the Fox series. The material has been reworked by the action of water and now occurs as outwash plains, stream terraces, or old valley fill.

The Plainfield series includes alluvial terrace soils, derived from glacial débris. Although the parent material was largely from a limestone region, the soil has been reworked to such an extent that there is not sufficient lime present to affect its agricultural value.

The Waukesha series includes dark-colored prairie or semiprairie soils which have been derived from reworked glacial material and deposited in the form of outwash plains and stream or lake terraces.

The Union series includes the light-colored forested upland soils of the unglaciated portion of the county, where the material is probably of residual origin from the underlying limestone, although there may be some influence from loessial material. This is the most extensive and important series in the driftless section of the county.

The Dodgeville series includes the dark-colored upland prairie soils of the unglaciated portion of the county, where the material probably is partly loessial and partly residual and derived in part from limestone, which occurs at a depth of 4 to 10 feet. The soils of this series constitute good farm lands.

The dark-colored upland prairie soils of the unglaciated region are classed with the Crawford series. The material is derived largely from the weathering of the underlying limestone rock and is now underlain by limestone, usually at less than 3 feet. The subsoil has a distinct reddish shade.

The La Crosse series includes the dark-colored prairie or semiprairie soils within the driftless region, where the material occurs as a terrace formation above present flood flow and where the parent material has been derived mainly from the unglaciated region.

The Boone series embraces the light-colored residual soils of the unglaciated region. The material has been derived largely from the weathering and disintegrating of a sandstone formation, in this instance the St. Peters sandstone.

The dark-colored soils of the unglaciated region, where the soils are of alluvial origin and occur as first-bottom land, are classed with the Wabash series. They are subject to overflow and require drainage. Similar dark-colored soils within the glaciated limestone region are included with the Clyde series. These soils occupy old glacial-lake beds, ponded valleys, or bottom land along the streams.

The Genesee series comprises the light-colored soils which occur as first-bottom land, where the material consists of reworked glacial débris.

The Rodman soils consist of light-colored assorted glacial débris. The material occurs as kames and eskers. This series is not extensively developed in Dane County.

Rough stony land includes areas of steep, rocky slopes, where the land is too steep or too rocky to be of value for cultivated crops. These areas may be considered as nonagricultural.

Madeland includes small areas where the surface material has been deposited by artificial means. It consists mainly of poorly drained areas which it has been desirable to fill in for building purposes.

Peat consists of vegetable matter in varying stages of decomposition, with which there may be incorporated a small amount of mineral matter. It occupies old lake beds, marshes, and poorly drained depressions. In its present condition it has but little value for crop production, but with drainage it forms a very valuable soil.

Muck includes soils high in organic matter and intermediate between Peat and the soils of the Clyde series.

Meadow includes first-bottom land which is low, poorly drained, and subject to overflow. The texture is so variable that no separation into established types can be made.

The following table gives the name and the actual and relative extent of each of the soils mapped in Dane County:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Miami silt loam	154,752	32.9	Waukesha fine sandy loam	6,208	1.0
Deep phase	98,752		Low-terrace phase	1,728	
Carrington silt loam	60,736	18.2	Crawford silt loam	7,424	1.0
Deep phase	79,296		Fox fine sandy loam	4,864	.6
Union silt loam	79,872	12.3	Clyde fine sandy loam	3,712	.5
Steep phase	15,104		Carrington fine sandy loam	3,584	.5
Peat	52,288	6.8	La Crosse silt loam	2,176	.3
Clyde silt loam	37,184	4.8	Plainfield fine sand	1,984	.2
Dodgeville silt loam	32,640	4.2	Rodman gravelly fine sandy loam	1,536	.2
Wabash silt loam	16,064	3.3	Boone loam	1,408	.2
Colluvial phase	9,216		Meadow	1,344	.2
Boone fine sandy loam	21,056	2.7	Fox loam	960	.1
Fox silt loam	17,600	2.3	Wabash loam	960	.1
Waukesha silt loam	12,480	1.7	Madeland	768	.1
Low-terrace phase	448		Miami loam	512	.1
Miami fine sandy loam	12,480	1.6	Clyde loam	320	.1
Rough stony land	10,752	1.4	Dodgeville fine sandy loam	128	.1
Miami gravelly fine sandy loam	10,368	1.3	Genesee fine sand	128	.1
Muck	8,448	1.1	Total	769,280	

Carrington Series.

The soils of the Carrington series are generally black, ranging in some cases to dark brown. The subsoils are lighter colored, and generally light brown or yellowish. The series consists principally of loams, silt loams, and clay loams, and is chiefly made up of what was formerly called Marshall loam, silt loam, and clay loam. The Carrington series is developed in the central and western prairie region, and consists mainly of prairie soils. The topography is gently undulating to rolling, though in some areas the surface is nearly flat. These soils are derived through weathering of glacial till, with little or no modification from loessial deposits. Two members of the Carrington series, the fine sandy loam and silt loam, are recognized in Dane County.

Carrington fine sandy loam.

The surface soil of the Carrington fine sandy loam has an average depth of about 10 inches. It consists of a dark-brown to almost black fine sandy loam. A small quantity of gravel, ranging from the size of a pea to that of a hickory nut, is frequently scattered over the surface and mixed with the soil. The subsoil varies widely, but is generally a yellowish-brown fine sandy loam, grading into a sandy clay loam in the lower part of the 3-foot section. Where the bedrock is near the surface and outcrops frequently, as is the case between Utica and Rockdale, the subsoil is usually a fine sand throughout, but such areas are small, often comprising less than an acre. Where the soil is thin there is often a large quantity of chert and limestone fragments in the subsoil. In a few places the surface soil of the type is a fine sand, but such areas are not large enough to be shown separately on the soil map.

The fine sandy loam is of small extent in Dane County, and of comparatively little importance. It is associated chiefly with the Carrington silt loam, and occurs largely on the tops of narrow ridges, drumlins, kames, and eskers, in small tracts. There are a few areas as large as 160 acres, but few larger than this. Some areas occur where the drift is thin and where the underlying limestone outcrops frequently.

The surface of the type is usually sloping, though it can not be considered steep except in a few places. The elevation is higher than the average for the Carrington silt loam, the type occupying chiefly the tops of hills. The soil is rather loose and open in structure, and the natural drainage is somewhat excessive. The type is likely to be droughty, especially where it is shallow.

The greater part of this type is derived from the weathering of glacial till. Where the soil is thin, however, it is probable that part

of the material has been derived from the weathering of the underlying limestone rock. The surface soil is strongly acidulent, although there is some limestone gravel present. The deep subsoil contains a large quantity of limestone material, and is seldom in an acid condition.

The Carrington fine sandy loam originally supported a scattering growth of oak and hickory, with a carpet of prairie grasses.

Very little of the type is under cultivation; it is used almost entirely for pasture. Alfalfa is grown in a few patches, and where this legume can be grown successfully such use of the land is more profitable than to leave it in permanent pasture. Liming and probably inoculation would be required in growing alfalfa.

CARRINGTON SILT LOAM.

The soil of the Carrington silt loam to an average depth of about 12 inches consists of a dark-brown to black silt loam, which contains a comparatively large amount of organic matter. There is frequently present in the surface soil some fine sand and a small quantity of fine gravel. The material is friable and less compact than the soil of the deep phase of this type. Litmus tests indicate that the surface soil is in an acid condition. The subsoil consists of a brown or yellowish-brown, rather friable silty clay loam in which lenses of fine sand and small quantities of fine gravel are of common occurrence. Below a depth of 16 to 20 inches the silty clay loam grades into a yellow sandy clay, and sometimes a thin layer of sandy loam is encountered at a depth of about 2 feet. Where this is the case the material in the lower subsoil grades into either a fine sand or a friable clay loam or clay. The heavy material predominates. The deep subsoil grades into typical glacial till, and the line of contact with the till is not so sharply defined as in the deep phase.

A number of variations occur in the Carrington silt loam, but only the deep phase, described later, is of sufficient extent and importance to be indicated separately on the soil map. Where this type borders the Miami silt loam it is lighter in color and contains less organic matter than typical. Where the main type grades into the deep phase it is somewhat more silty and loesslike, there is less fine sand present near the surface, and the type is somewhat deeper than typical. Bordering the Miami fine sandy loam or Carrington fine sandy loam there is usually more fine sand in the surface soil and subsoil. In the southeastern part of the county the type includes a number of fine sandy loam and gravelly spots, chiefly on elevations, but these are usually only a few acres in extent and can not be shown on the soil map. The underlying limestone outcrops in a number of places, and over the tops of some of the higher elevations the soil is thin.

In the shallow areas the subsoil is frequently stony, and may be partly residual. On some of the steep slopes the surface soil has been removed by erosion, and in some places the underlying till bed is exposed, while in other places the clay loam subsoil comes to the surface. Areas of the deep phase are scattered throughout the typical soil, but where these are small they are not mapped separately, since in all cases the boundary lines between the type and the phase are more or less arbitrary.

The Carrington silt loam resembles the Miami silt loam in texture and structure, and in topography, but differs from that type in color and in being a prairie rather than a forested soil. It corresponds to the Dodgeville silt loam in color, organic-matter content, and its prairie condition, but contains more fine sand and occurs in the glaciated instead of the unglaciated region.

The Carrington silt loam with its deep phase is one of the most important and highly prized soils in the State. In Dane County it is found most extensively in the southeastern section, in Cottage Grove, Deerfield, Pleasant Spring, Christiana, Dunkirk, and Albion Townships. Other scattered areas of smaller extent are found in the northern part of the county in Sun Prairie, Burke, Westport, Vienna, Springfield, and Dane Townships. There is an area of 8 or 9 square miles in Middleton Township, and smaller patches are encountered in other parts of the county within the glaciated region.

The surface of this type varies from undulating to rolling. There are a few tracts of level land, but these are of very small extent. In Springfield and Dane Townships and in a few other localities there are outcrops of the underlying limestone, and on the hills where these outcrops occur the covering of drift is shallow. In the vicinity of Norway Grove the surface is interrupted by a number of kames, eskers, and other morainic hills. Where the slopes are steep erosion has carried off the surface soil, leaving the heavier subsoil exposed, but such places are of small extent and of infrequent occurrence. As a whole the type suffers but little from erosion where ordinary care is exercised in cultivating the sloping land. On account of the surface features of this type the natural drainage is good, and there are only a few small areas which are in need of tile drainage.

The material composing the Carrington silt loam is derived from weathering of the mantle of glacial till. The silt in the surface soil may be partly loessial, while the sand, gravel, and bowlders are undoubtedly of glacial origin. All the deep subsoil consists of glacial till, and in some places this forms the surface soil. The loesslike characteristics are less pronounced in the typical soil than in the deep phase. The gravel, stones, and bowlders which are present in the till are largely of limestone, and while the surface soil is in an acid

condition, the lower subsoil, consisting of the till, is not acid, but is well supplied with carbonate of lime.

The Carrington silt loam is a typical prairie soil, and the native growth consisted almost entirely of prairie grasses. Along the border of the type, along some of the stream courses, and over the limestone hilltops there was some timber, consisting chiefly of oak, hickory, and maple. Such areas, however, were small. Practically the only trees now standing are those which have been planted about farm buildings and along highways.

Probably over 80 per cent of the main type is under cultivation, and the remainder is chiefly devoted to permanent pasture. The principal type of agriculture followed on this soil is general farming. In some localities dairying is practiced, and the tendency seems to be toward the more extensive development of this industry. Tobacco is an important special crop on this soil.

The type is well adapted to corn, producing an average of 40 bushels per acre. Much larger yields are often obtained, and the production of 50 to 65 bushels per acre is commonly reported. Oats produce an average yield of 38 to 40 bushels per acre. Barley yields about 30 bushels, and wheat about 15 bushels, though but little wheat is grown. The quality of the small grains is not quite so good as is produced on the light-colored silt loams, such as the Miami silt loam. The hay consists chiefly of a mixture of timothy and clover, and yields of 1½ to 2 tons per acre are harvested. A small amount of alfalfa is grown, but it is confined to small patches. Where the soil is properly prepared alfalfa does very well, and the acreage is gradually increasing, especially where dairying is being carried on.

Tobacco is the most important special crop grown on this type, and it receives a great deal of attention, especially in the southeastern part of the county. Yields range from 1,000 to 1,600 pounds per acre. Sugar beets are grown to a limited extent, and yields range from 10 to 16 tons or more per acre. The sugar content is not quite so high as from beets grown on the Miami silt loam, deep phase, but the yield is greater.

There are a few home apple orchards on this type, and small fruits and berries are grown to some extent for home use, but neither the fruit industry nor trucking has been developed on a commercial scale.

The rotation of crops on this soil is given less attention than on some of the other soils of the county. One reason for this indifference is that tobacco receives so much attention that frequently other crops are somewhat neglected. Tobacco is usually grown on the same field for a number of years, and seldom in a rotation. Where alternated with the general farm crops the rotation generally followed consists of corn, followed by small grains seeded to timothy

and clover, and then tobacco for two or three years on the same field, followed by corn.

The Carrington silt loam is not a difficult soil to cultivate, and a mellow seed bed can be readily worked up. On the steeper slopes, where the heavy subsoil is sometimes exposed, the soil is harder to work than in the typical areas, and on account of the slopes, some of which are rather steep, some inconvenience is experienced in growing and harvesting the crops. Areas of this kind, however, are of small extent. There is a general need for more thorough cultivation. Stable manure is the only fertilizer used with the general farm crops, and it is used for tobacco to a greater extent than any other form of fertilizer. Twenty to forty loads per acre are often applied to the tobacco field. The supply is not ample, however, and a large part of most of the farms receives too little stable manure. The practice of plowing under green-manuring crops is not common.

The soil of the Carrington silt loam is in an acid condition, and responds to the application of ground limestone at the rate of 1,500 to 2,000 pounds per acre. With such treatment and the inoculation of the soil alfalfa can be grown successfully. This a valuable crop, particularly where dairying is practiced.

Farms on the typical Carrington silt loam range in value from $60 to $110 an acre, depending upon the location, character of the topography, and the improvements. In the tobacco-growing sections some of this soil has a still higher value.

Carrington silt loam, deep phase.—The soil of the Carrington silt loam, deep phase, to an average depth of about 12 or 14 inches, consists of a dark-brown to almost black silt loam, having a smooth feel and containing large quantities of organic matter. The material is rather compact, and litmus tests indicate that the surface soil is in an acid condition. The subsoil consists of a dingy-brown silt loam in the upper part, becoming lighter in color and heavier in texture with depth, until at 22 to 26 inches the material is a yellowish-brown, compact silty clay loam, in which the silt content is very high. This heavy material usually extends to a depth below the reach of the 3-foot auger, and ranges from 2 to 8 feet in thickness. The entire soil section is practically free from gravel, stones, and bowlders, and is remarkably uniform in its loesslike structure and texture. Immediately below this loesslike mantle the typical glacial till, consisting of clay, silt, sand, and gravel, is encountered. The line of demarcation between the yellow or yellowish-brown silty clay loam and the unassorted till is well defined, the upper part being free from bowlders and gravel and leached free of calcium carbonate, while the till is filled with stones and bowlders and is well supplied with calcium carbonate.

This phase is subject to some variation where it borders other soils. Where it borders the Miami silt loam, deep phase, the color is somewhat lighter and there is less organic matter present. In some places there is also an appreciable amount of fine sand in this border phase. This condition is even more marked where the type borders a fine sandy loam. Where the phase borders the Clyde silt loam a number of steps appear in the weathering of the subsoil, grading from the dark or drab subsoil of the Clyde to the dingy brown or yellow of the Carrington. The water table becomes lower and the soil oxidation more marked with improved drainage conditions. Over some of the higher elevations of the type the loesslike covering is rather shallow, but the depth to underlying rock ranges from 10 to 50 feet throughout the phase.

The deep phase of the Carrington silt loam resembles the Miami silt loam, deep phase, in texture, structure, and to a certain extent in origin. It differs from the Miami, however, in that it is darker in color, contains more organic matter, has a more nearly level topography, and occupies prairie instead of forested regions. The phase resembles the typical Carrington silt loam in color, texture, and structure, but differs from it in having a more nearly level surface and in having a deeper section over the glacial till. The Carrington silt loam, deep phase, resembles the Dodgeville silt loam in color and texture, except in the deep subsoil of the Dodgeville, where the material frequently becomes red as the underlying limestone is approached. The Carrington soils, however, occur in glacial regions, while the Dodgeville is confined to the unglaciated regions over which a mantle of loess has been deposited.

The Carrington silt loam, deep phase, is an extensive and important soil in Dane County. The largest area occurs in the northern part of the county, in Bristol, Windsor, Vienna, Dane, Burke, and Springfield Townships, extensive tracts lying north, northeast, and northwest of Madison. The phase is also encountered in the southeastern part of the county, in Dunkirk, Albion, and Christiana Townships. A few other smaller patches are found in various parts of the glaciated region within the area surveyed. The deep phase is closely associated with the typical Carrington silt loam, and grades into it so gradually that a boundary between the type and the phase is often difficult to establish and is always more or less arbitrary.

The surface of the phase varies from level to undulating and in some places gently rolling. The elevation ranges from 850 to 1,100 feet above sea level, and differences of 100 feet sometimes occur within a mile. The slopes are long and gentle, and there is seldom any damage from erosion. In most places the surface has a sufficient slope to provide good natural drainage, but in the level areas the drainage is somewhat deficient and tiling is needed.

The deep phase differs slightly from the typical soil in that the mantle of loesslike material is thicker and more uniformly distributed. The extremely silty material has a depth of 2 to 8 feet, and between this and the underlying typical glacial till there is a sharp line of demarcation which is not nearly so conspicuous in the typical soil. The gravel, stones, and bowlders in the drift are largely of limestone, and while the soil is in an acid condition, the deep subsoil composed of till is not acid and contains a large amount of carbonate of lime.

The deep phase is a prairie soil, and the native growth consisted almost entirely of prairie grasses, with some oak, maple, and hickory near the boundaries of other types and along some of the streams.

Practically all of this soil is under cultivation, or has been tilled, and the percentage in permanent pasture is not so great as is that of the typical soil, because the topography is more nearly level and there are no steep slopes. There is only a very small acreage of waste land, and the percentage of waste land is probably smaller than for any other type in the county. The same crops are grown as on the typical soil, but the deep phase is more desirable for agriculture, and the yields average a little higher. Corn yields an average of about 45 bushels per acre, but where the best methods of farming are followed yields of 60 to 75 bushels per acre are not uncommon. Oats yield 40 to 45 bushels, with considerably higher yields under good management. Some barley is grown. The acreage of wheat is very small. Hay, consisting of clover and timothy, yields $1\frac{1}{2}$ to $2\frac{1}{2}$ tons per acre. Alfalfa is grown to a small extent. As with the typical soil, tobacco is the leading special crop, and is extensively grown in the southeastern part of the county. Yields are about the same as for the typical soil, possibly averaging a little higher. Sugar beets yield 12 to 18 tons per acre, and they are grown quite extensively, especially in the northern part of the county.

The same conditions as to crop rotations prevail as on the typical soil, and the interest of many of the farmers is concentrated on the tobacco field to the neglect of the remainder of the farm. Because of this condition the general methods of farming practiced in the tobacco-growing sections are not of so high a standard as in many regions of inferior soils where tobacco is not grown. The yields of the general farm crops are, therefore, hardly a fair indication of what this soil is capable of producing under the best methods of farming.

The methods of cultivation, fertilization, and crop rotation are practically the same as for the typical soil. The deep phase is more nearly level, and the drainage is not as good as on the main type. Over the extensive level or undulating tracts tile drains are needed. A system of tile drainage permits the soil to warm up earlier in the

spring, so that crops may be planted sooner. Well-drained land works up more readily into a mellow seed bed and permits a more rapid, vigorous growth.

As is the case with the typical soil, the deep phase is in an acid condition. It requires the same corrective treatment.

Because of the more nearly level character of the deep phase, the greater depth of the soil section, and the fact that it is capable of producing somewhat higher yields, it has a higher value than the typical soil. Where devoted to general farming the selling price ranges from $110 to $150 an acre. In the tobacco-growing section land in small tracts frequently sells for as much as $200 to $300 an acre.

Miami Series.

The soils of the Miami series are brown, light brown, or grayish, and are underlain by yellowish and brown, heavier textured subsoils. Mottlings of brown and light gray are present in the subsoils in many places, particularly in the case of the clay loam member. The surface drainage is usually good, but artificial drainage is necessary in some of the heavier types. The soils are mainly derived through weathering from glacial till generally of a calcareous nature. The Miami series includes four types in Dane County—the gravelly fine sandy loam, fine sandy loam, loam, and silt loam.

Miami gravelly fine sandy loam.

The surface soil of the Miami gravelly fine sandy loam consists of a medium to dark yellowish brown fine sandy loam, which extends to a depth of 6 to 10 inches. There is a large quantity of gravel on the surface and mixed with the soil, and in places bowlders occur on the surface. The surface soil grades into a gritty clay loam, usually containing considerable gravel. The amount of gravel and sand below 12 or 18 inches increases with depth, and it is usually impossible to bore to a depth of 3 feet on account of the gravel.

This type covers 16.2 square miles, and is quite widely distributed throughout the glaciated part of the county. It is closely associated with the Miami fine sandy loam and Miami silt loam, and a number of areas too small to indicate on the map are included with those types.

The type usually occurs on the tops of drumlins or in areas of rolling or somewhat broken land in the morainic sections. The surface is always sufficiently rolling to provide thorough natural drainage, and in places the drainage is excessive. There is some danger from erosion, and the steep slopes are gullied to some extent in places.

The material composing the Miami gravelly fine sandy loam con-

sists of glacial débris occurring in the form of drumlins or as recessional moraines. Much of the gravel present consists of limestone.

The original growth consisted of oak, hickory, and some maple. Because of its sandy and gravelly nature and its topography, very little of the type is under cultivation, most of it being in permanent pasture. A large part of this soil is still forested.

MIAMI FINE SANDY LOAM.

The Miami fine sandy loam is a variable type, and is of moderate extent in Dane County. Over the greater part of the type the surface soil, extending to an average depth of about 10 inches, consists of a light-brown or grayish, rather silty fine sandy loam, which contains only a small amount of organic matter and is usually in an acid condition. The subsoil consists of a yellowish-brown fine sandy loam which gradually changes into a sandy clay at 16 to 24 inches. At 2 or 3 feet a clay loam is frequently encountered, but the texture at this depth is extremely variable and may range from a clay loam to a fine sand. In a few places the bedrock, consisting of St. Peters sandstone, is encountered at about 3 feet. Both soil and subsoil may contain varying amounts of gravel and small stones, most of which consist of limestone. Some gravel occurs on the surface in places, but the gravel and stones are not present in sufficient quantities to detract from the value of the soil. The subsoil, especially in the lower part, is a heterogeneous mixture of sand, gravel, silt, and clay, and consists of typical unassorted glacial till.

The type includes an unmapped light phase, which consists of a light-brown fine sand, underlain at about 10 inches by a yellow or yellowish-brown fine sand, which grades at 15 to 20 inches into a fine sandy loam. The material gradually becomes heavier with depth, and at 2 to 3 feet it is usually a sandy clay or a clay loam. Some gravel and small stones are present, as in the typical soil.

Throughout the type there are numerous areas of fine sand which are too small to be indicated on the map, and a few small patches of silt loam also are associated with this type.

The most extensive areas of this soil are in Rutland and Dunkirk Townships, and these extend into Rock County on the south. The light phase occupies small patches which are scattered through various parts of the glaciated section of the county and occur mainly in the southern part.

The surface of the Miami fine sandy loam varies from gently rolling to very rolling. In Christiana and Pleasant Spring Townships it occupies the tops of drumlins. West of Rutland and at a number of other points it is found in very hummocky, kettle-basin moraines. The greater part of the type, however, occurs in the

region of ground moraine. On account of the surface features and the sandy nature of the soil the natural drainage is well developed. In the sandy areas it is sometimes excessive and the soil is somewhat droughty. Erosion is seldom injurious.

The Miami fine sandy loam is derived from the weathering of the unassorted glacial till, modified by lateral and recessional moraine material. Where the sand is deepest the surface has been influenced somewhat by wind action, but such modification is not extensive. The underlying rock consists of St. Peters sandstone and limestone. The parent material is derived from both of these formations.

The original forest growth consisted of white, red, and bur oak, with some hickory, maple, and a very little elm on the heavier portions of the type.

Probably 75 per cent of the Miami fine sandy loam is under cultivation, while the remainder is in permanent pasture and woodlots. The type is closely associated with the Miami silt loam, and the crops grown and the methods of farming followed are very nearly the same as on that type. But few farms are made up entirely of the fine sandy loam, and, as it is of small extent, special methods have not been devised for this particular soil. Corn produces an average of about 33 bushels, oats 30 bushels, barley 25 bushels, wheat 15 bushels, and rye 18 bushels per acre. Clover and timothy mixed produce 1 ton to 1½ tons of hay per acre. Where potatoes are grown, the yield averages about 125 bushels per acre. Tobacco is a special crop which receives considerable attention and yields of 1,000 to 1,300 pounds per acre are obtained. Yields of all the crops mentioned are smaller on the light phase than on the main type.

The rotation of crops most commonly practiced consists of corn, followed for about two years by small-grain crops, the last of which is seeded to timothy and clover. Hay is usually cut for two years, and the field may be pastured for a year before being again plowed for corn. Stable manure is the only fertilizer used, and where tobacco is grown most of the manure is applied to the tobacco patch.

The soil is easy to cultivate, and no difficulty is experienced in working up an excellent seed bed. It is low in organic matter and usually in an acid condition at the surface. The organic-matter content may be increased by supplementing the stable manure with green-manuring crops, and the acidity is corrected by applying ground limestone at the rate of 1,200 to 2,000 pounds per acre.

On account of the sandy nature of the soil this type is better adapted to the production of special crops than to general farming. Potatoes, beans, cucumbers, strawberries, tomatoes, etc., do well, and their cultivation might profitably be extended where the location is favorable for marketing. Apples also do well on this soil.

The selling price of land of this character usually ranges from $40 to about $90 an acre, depending upon the location, improvements, and other factors.

MIAMI LOAM.

The surface soil of the Miami loam has an average depth of about 10 inches, and consists of a light-brown loam containing a large quantity of fine sand and silt. The subsoil consists of a yellowish-brown, heavy sandy loam or sandy clay loam which becomes somewhat heavier with depth. At about 2 feet the unassorted glacial till, consisting of sand, clay, gravel, and bowlders, is encountered. The surface soil is rather low in organic matter. Most of the gravel and stones are limestone. There are a few minor variations in the soil, chief among which is an approach toward a fine sandy loam. The type appears to be a gradation between the silt loam and the fine sandy loam of the Miami series.

This type is of very small extent and of minor importance in this county. It covers only 512 acres. The largest area lies 2 miles southwest of South Madison. Other small areas are encountered in various parts of the county, in association with the silt loam and fine sandy loam of the same series.

The surface varies from gently rolling to rolling, and the natural drainage is good. There are probably no areas of the type which are especially in need of tile drainage. On some of the steeper slopes there is some danger of erosion, but little damage has resulted from this source.

The Miami loam is derived from the weathering of the unassorted glacial till, most of which was originally ground from the underlying limestone. The surface has been leached to a considerable extent, however, so that it is frequently found to be in an acid condition, while the subsoil is usually quite calcareous.

The original forest growth consisted of several varieties of oak, with some hickory, maple, basswood, and elm.

About 75 per cent of this soil is under cultivation, and the remainder is in permanent pasture and woodlots. General farming is the chief type of agriculture, and dairying is practiced to some extent. The crops grown, yields obtained, and the methods of cultivation, fertilization, and crop rotation are practically the same as on the Miami silt loam. The type responds to the same methods of improvement.

MIAMI SILT LOAM.

The surface soil of the Miami silt loam has an average depth of 10 to 12 inches. It consists of a light-brown silt loam, which frequently has an ashen appearance when dry. There is often present

in the surface soil an appreciable amount of fine gravel, and a few small stones are sometimes present on the surface, chiefly along the higher elevations. Where the silt content is highest the type is usually free from gravel and small stones, and in these places the surface soil somewhat resembles loess. It is also deeper in such places than where fine sand or coarser material is mixed with the silt. Where the surface material is most like loess and of considerable depth a deep phase is recognized and mapped.

The subsoil of the typical Miami silt loam consists of a brown or yellowish-brown silty clay loam which gradually becomes lighter in color, and in some places lighter in texture, with depth. Where the surface is extremely silty the loesslike material may extend to a depth of 2 feet and then grade abruptly into unassorted till consisting of silty clay, sand, and gravel. Where the surface material is shallower, the entire subsoil section usually consists of the till, and this grades from a silty clay loam into a heavy fine sandy loam or even a fine sand at 30 to 36 inches. The subsoil usually contains a large quantity of fine gravel and enough sand to give the material a gritty feel, especially in the lower part.

The type is subject to considerable variation, especially in the depth of the loesslike covering and the amount of sand and fine gravel present. In the southern part of the county it contains more fine sand than in the northern section. On some of the higher elevations the loesslike covering is absent and the silty clay subsoil exposed over small tracts, while on the lower slopes in the same locality the surface soil is considerably deeper than the average. In the southern part of the county a reddish-yellow clay loam subsoil is encountered at about 2 feet in a few places, but such areas are of small extent. In a few small areas on knolls gravel beds are encountered, and these can sometimes be reached with the soil auger. By far the greater part of the gravel associated with this type is limestone, and the soil material is generally calcareous. The surface soil has frequently been leached to a considerable extent, and in some places it is slightly acid. The subsoil, however, is never in an acid condition. There is some variation in the color of the type, largely where this soil borders darker soils like the Carrington silt loam or soils of the Clyde series. In such localities the surface has a dark-brown color and the soil a higher content of organic matter than typical.

The Miami silt loam resembles the Carrington silt loam in texture, but differs from that soil in being a light-colored forested soil and in having a somewhat rougher topography.

The Miami silt loam, with its deep phase, is the most important type in the county. The typical soil is distributed throughout the glaciated part of the county and is closely associated with its deep

phase, with the Miami fine sandy loam, and with soils of the Carrington series. The most extensive areas occur in Medina, Middleton, Springfield, Dane, Berry, and Roxbury Townships. With its phase, this type covers almost one-third the county.

The surface features of the typical Miami silt loam range from gently rolling to rolling, with occasional areas where the surface is only undulating. In the northern part of the glaciated region, especially in Medina Township, there are a number of drumlins upon which the type occurs. Kames and eskers are frequently associated with this soil, giving the surface a somewhat bumpy or choppy appearance. While the differences in elevation may range from 50 to 150 feet within about 2 miles, there are but few slopes too steep to be cultivated, and modern farm machinery can be used on practically all the type. In the southwestern part of the glaciated region the topography differs somewhat from that in other places, inasmuch as the covering of glacial débris is shallow, and the preglacial topography is everywhere in evidence. This probably is most pronounced in Rutland Township. The slopes of some of the hills in this section have but little soil covering, and rock outcrops are numerous.

On account of the surface features of this type the natural drainage is good. It is excessive in a few places where there is more gravel than usual in the soil or occurring in beds beneath the type. The steeper slopes are subject to erosion. But little of the type, however, has been seriously damaged by erosion.

The Miami silt loam is derived from the weathering of the glacial till and the loesslike material which is encountered throughout most of its area. The mantle of loesslike material is much thinner over the typical soil than over the deep phase, and the glacial till thus enters into the main type to a greater extent than is the case with the deep phase. The underlying rock is chiefly limestone, and it gives rise to the limestone gravel in the soil section. A large part of the soil material has doubtless been derived from the underlying limestone. In the southern part of the county there are a number of small areas where the St. Peters sandstone occurs, and it is quite probable that the presence of this rock accounts for the more sandy nature of the Miami silt loam in the southern part of the survey. The calcareous nature of the subsoil is due to the influence of the limestone. The surface soil, while slightly acid in some places, is not so much in need of lime as the soils of the Carrington series, and but little lime is applied to this soil in Dane County. The roots of plants soon reach the subsoil, and the slightly acid condition of the surface soil has but little effect, even upon alfalfa.

The original forest growth on the Miami silt loam consisted chiefly of white, black, and red oak and maple, with some hickory, basswood,

and elm. Over a part of the type the timber growth was scattered, and the term "oak openings" is frequently used to describe this condition. The typical soil was more heavily forested than the deep phase.

It is estimated that approximately 80 per cent of the typical Miami silt loam is under cultivation, while the remainder is chiefly devoted to permanent pasture. The chief type of agriculture followed consists of general farming. Dairying is carried on only to a comparatively small extent, and special crops receive but little attention. Farming operations are confined chiefly to growing corn, small grains, and hay. Corn averages about 35 bushels, oats about 35 bushels, barley 25 bushels, wheat 10 to 30 bushels, and timothy and clover hay mixed 1 ton to 1½ tons per acre. In the southeastern part of the county tobacco is grown as a special crop, chiefly in the vicinity of Stoughton, Oregon, and Utica. Yields range from 1,100 to 1,700 pounds per acre. Where this crop is grown it is given much more care and is fertilized much more heavily than other crops. Dairying is carried on more extensively in the vicinity of Verona than elsewhere on this type.

On the whole, this type is easily handled. Where the subsoil is exposed on the slopes and hilltops cultivation is sometimes difficult, but such areas are small. Fall plowing is practiced to some extent for oats and corn. Stable manure is the only fertilizer used for general farm crops, and where tobacco is grown the greater part is applied to the tobacco patch. The rotation most commonly followed consists of corn, followed by a small-grain crop for two years, and then timothy and clover. Hay may be cut for two years and the field pastured for a year before being again plowed for corn.

This type seems best suited to dairying and stock raising. The supply of organic matter in the soil can be increased by supplementing the stable manure with green-manuring crops. Deeper breaking and more thorough cultivation are needed to improve the productiveness of the soil. Alfalfa, which is now grown to a very small extent, is a valuable crop for every farm, especially the dairy farms. Where an acid condition exists in the soil the application of some form of lime is needed. It is necessary to cultivate the steep slopes in such manner as to prevent erosion. Many of the steep areas are best kept in permanent pasture. They are suitable for the raising of sheep.

The value of land on the Miami silt loam ranges from about $50 to $110 per acre.

Miami silt loam, deep phase.—The soil of the Miami silt loam, deep phase, to an average depth of 12 to 14 inches consists of a light-brown, friable silt loam, with a low content of organic matter, but high in silt. The color of the soil varies somewhat with the moisture content, the surface presenting an ashen appearance when dry. With

a few exceptions, the surface is practically free from gravel and stones, and but few areas contain as large quantities of fine sand as occur in the typical soil. The subsoil consists of a yellowish-brown silt loam. The material gradually becomes heavier with depth, and at about 24 inches it is usually a silty clay loam. This heavy material extends to a depth of 3 to 6 feet, where true glacial till, consisting of a mixture of sand, silt, clay, and gravel, is encountered. Both soil and subsoil have a very smooth feel and a loesslike structure. The upper subsoil sometimes contains small lenses of fine or very fine sand, while the lower subsoil may be slightly mottled with brownish red, yellow, or drab, owing to the unequal oxidation of the material. There is a sharp line of demarcation between the loesslike material and the underlying true glacial till, the stones, bowlders, or gravel being almost or entirely lacking in the upper part, but rather numerous below. The gravel in the till consists chiefly of limestone.

While this phase as a whole is uniform, it is subject to some local variations. Where this soil borders the Carrington or Clyde soils the color at the surface is darker than typical. Where it borders the typical Miami silt loam or the Miami fine sandy loam the subsoil is frequently somewhat sandy below a depth of 24 to 36 inches. In a few places knolls or small hills occur within the type over which the silty covering is shallow and where the subsoil consists chiefly of the glacial till. Such areas, where of sufficient extent, are included with the typical soil.

The Miami silt loam, deep phase, resembles the Union silt loam quite closely in color and texture, and has a similar loesslike structure. It is underlain, however, by true glacial till and derived, in part at least, from that source. The phase also resembles the Carrington silt loam, deep phase, in texture and structure, and has nearly the same origin. It is a light-colored soil, however, and was originally forested, while the Carrington soils are dark colored and occur in prairie regions.

The Miami silt loam, deep phase, is an important soil in Dane County. Its most extensive development is in the northeastern section, in Sun Prairie and York Townships.

The surface of this phase is generally less broken than that of the main type. The topography varies from gently undulating to gently rolling, the slopes being long and gentle. There are some small areas where the surface is nearly level, and in which, even where the surface has a gentle slope, tile drains are sometimes needed. Over most of the phase, however, the natural surface drainage is good. The soil is somewhat more compact than in the main type, and the downward movement of water is not so rapid as in the lighter textured soils. The soil retains moisture very well, and crops suffer less

during long dry periods than on most of the other soils of the county. The phase is not subject to destructive erosion.

The deep phase of the Miami silt loam owes its origin to the weathering of the loesslike covering over the glacial till. This loessial material occurs as a mantle over all of this phase. It may have been blown on the glacial ice sheet which covered this region, gradually settling as the ice melted as a covering over the glacial débris. The underlying material consists of typical glacial till. It contains large quantities of limestone material, and is highly calcareous, while the surface loessial material contains but little calcium carbonate, and is frequently in an acid condition. The phase is made up more largely of this loessial material than the typical soil. The underlying rock, from which much of the glacial till is derived, is limestone.

The original forest growth on the phase was not as dense as on the typical soil and much of this land was referred to as "oak openings." The timber consisted of white, red, and black oak, hickory, maple, basswood, and some elm. Practically all of the merchantable timber has been removed, and about all that is now left is in small tracts of 1 to 10 acres of second-growth trees, suitable chiefly for fuel.

There is only a very small part of this phase not cultivated. It constitutes good agricultural land, and many highly improved farms are located upon it. General farming is the chief type of agriculture followed. Dairying is carried on to some extent, and special crops are grown in some sections. For quality of products this phase is unexcelled in the county and only the Carrington silt loam, the Clyde soils, and the Waukesha soils produce heavier yields of certain crops. Corn yields about 40 bushels per acre on the average, and oats about the same. Barley averages 30 bushels, and wheat produces 10 to 30 bushels per acre. For a number of years wheat was not grown, the farmers claiming that it could no longer be produced profitably. During the last few years, however, some very successful crops have been grown. Clover and timothy, mixed, yield 1½ to 2½ tons per acre.

In York Township a number of farmers are engaged in growing peas. Peas for canning yield about 2,000 pounds per acre, and dry peas about 20 bushels per acre, although larger yields are frequently reported. Where the green peas are used for canning the vines make good ensilage, and may be utilized profitably for feeding cattle. The leading varieties of peas are the Alaska, a very early pea, and the Horsford and Advance, which mature somewhat later. Sugar beets are grown in Sun Prairie and Bristol Townships, with yields of 10 to 17 tons per acre. The sugar content is higher than that of beets grown on the dark-colored soils. Between Sun Prairie and Waunakee, and to a smaller extent in the vicinity of Marshall, tobacco is grown as a special crop. Considerable tobacco is also grown on this phase in the vicinity of Albion, though this soil is

more limited in extent in the southern and southeastern sections of the county than in the northern and northeastern. Yields of tobacco range from 1,000 to 1,800 pounds per acre.

In general the same methods of farming are followed on this phase as on the typical soil. While the texture of the phase is somewhat heavier than that of the typical soil, it is as easily cultivated, as there are no steep slopes. The drainage is not as thorough, however, and in the nearly level areas the phase is a little later than the main type. The rotations followed, methods of fertilization, etc., are the same as for the typical soil, and the same methods of improvement are needed. The dairy industry offers good opportunities on this phase, and in general it is suited to a more intensive system of farming. Tiling is advantageous where the land is nearly level, and backward in the spring. Where tobacco is grown the remainder of the farm is frequently neglected. The tendency at present seems to be to reduce the tobacco acreage, and to give increased attention to the dairy industry. The acreage in alfalfa might be extended with profit, and as on the typical soil more thorough cultivation is needed.

The value of land of this character ranges from $100 to $150 an acre. In regions where tobacco is grown extensively the price for small tracts of land is still higher.

Rodman Series.

The types included in the Rodman series have surface soils varying in color from medium or light grayish brown to yellowish gray, with sometimes a slight reddish cast. The subsoil is brown, usually of a darker shade than the soil. The material is assorted to a greater or less extent—always much more so than glacial-till materials—so that the soils are more leachy, less retentive of moisture, and more droughty than the soils derived directly from till. The material may contain sandstone, shale, limestone or granite, gneiss, or other crystalline rocks. The deposits have been formed within or underneath the ice and left as characteristic kames and eskers of the glacial regions. The topography is rolling to hilly or steep and rough, with occasional flat-topped or truncated hills. The soils of this series have not been subjected to material modification by glacial-lake waters, though in some cases they may have been covered by them. The kame and esker material, which has been subjected to considerable modification, is classed with the Dunkirk or some other glacial-lake series. In Dane County the Rodman series is represented by a single type, the gravelly fine sandy loam.

Rodman gravelly fine sandy loam.

The surface soil of the Rodman gravelly fine sandy loam usually consists of a light-brown fine sandy loam. It contains large quantities

of gravel. At a depth of 4 to 6 inches this material grades into stratified beds of sand and gravel which extend far below the 3-foot limit of the soil section. The surface material is variable and is a loam in places, but it is always shallow and underlain by sand and gravel.

This type has a total area of 2.4 square miles. It is associated with the Miami silt loam and to some extent with the Carrington silt loam.

The surface is rolling, broken, and hilly, or it may consist of long, narrow ridges. Because of the gravelly nature of the subsoil and the uneven character of the surface the natural drainage is excessive and the type is extremely droughty.

The type is derived from kame and esker material, deposited beneath the ice sheet after having been worked over and assorted by running water. The gravel present is largely of limestone origin.

The native growth on this soil was chiefly oak, with some hickory and maple.

The type is used only for pasture and it supplies fairly good grazing for a part of the spring and early summer, but the grass dries up with the first dry period and affords little grazing during the rest of the season. This soil is not suited to cultivated crops.

Fox Series.

The types of the Fox series have brown surface soils and brown to yellowish-brown subsoils. The series has typically a level topography, drained here and there by potholes or by valleys eroded since the deposition of the material as outwash plains, or as terraces along streams within the glacial area or flowing out of it. The soils, therefore, consist largely or wholly of glacially derived material, but an essential characteristic is the presence of at least 25 per cent of limestone. In Dane County three types of the Fox series are recognized. These are the fine sandy loam, loam, and silt loam.

FOX FINE SANDY LOAM.

The surface soil of the Fox fine sandy loam has an average depth of about 10 inches, and consists of a brown to light-brown fine sandy loam. The soil is fairly high in organic matter. Litmus-paper tests indicate that it is slightly acid in places. The subsoil is lighter in color, but slightly heavier in texture, than the surface soil. At about 20 inches it is usually a yellow fine sandy loam. In places this material extends to a depth of more than 3 feet, and in others a bed of stratified medium and fine sand is encountered at about 2 feet. In a few instances the subsoil between 2 and 3 feet has a somewhat reddish cast.

The type includes an unmapped heavy phase, in which the soil consists of a light-brown silty fine sandy loam. A sandy clay

loam is encountered at 18 to 20 inches. At a depth of 2 to 3 feet the stratified beds of sand occur, as in the typical soil. The extent of this phase is very limited. It is confined to one area immediately northeast of Belleville, on a terrace in the valley of Sugar River.

The Fox fine sandy loam is of small extent and is confined chiefly to the valley of the Wisconsin River, and to the south-central edge of the county. A few small areas occur about 3½ miles south of Windsor.

The surface of the type is level or very gently undulating, and the natural drainage is good, except in a few places where the water table is near the surface. The soil occurs as a terrace above the present flood plain, and no part of it is subject to overflow.

In origin the material composing the Fox fine sandy loam is alluvial. It was deposited by the streams when they flowed at higher levels than at present. The parent material consists of glacial débris, derived largely through glacial action from limestone. While this glacial material contained varying quantities of limestone, much of the carbonate of lime has been removed by water action. Portions of the type are slightly acid, but this condition is not nearly so marked as where no limestone was present in the parent material.

The original forest growth consisted chiefly of oak, maple, hickory, and basswood, but practically all of this has been removed.

Most of the Fox fine sandy loam is under cultivation, and fair yields are obtained. It is devoted to general farming, and corn, oats, barley, and hay are the chief crops. The yields on this type are somewhat lower than on the well-drained areas of the silt loam, but it is a fair agricultural soil and is easily worked. As the supply of organic matter is not ample, the use of green-manuring crops is advantageous. Where an acid condition has developed this may be corrected by applying ground limestone at the rate of 1,200 to 1,500 pounds per acre. The type is probably better adapted to truck crops than to general farming, and in favorable locations trucking offers good opportunities. Land values on this type range from $40 to $100 an acre.

FOX LOAM.

The surface soil of the Fox loam, extending to an average depth of 10 inches, consists of a brown loam which contains large quantities of silt and very fine sand. The organic-matter content is somewhat higher than usual for this type, and the color frequently approaches that of the Waukesha soils. The subsoils consist of yellowish-brown loam to silt loam, with a small percentage of fine and very fine sand. The content of sand usually increases with depth, and the entire

type is underlain by stratified beds of sand and gravel. In a few places the gravel lies within 2 feet of the surface. Even where there is considerable limestone material in the gravel, the surface soil is strongly acidulent in many instances, as indicated by the litmus-paper test.

The Fox loam is an inextensive type in this county. The largest area, comprising slightly more than a square mile, occurs in the south-central part of the county, immediately northwest of Brooklyn. A smaller area is encountered southeast of Sauk City, in the northwestern corner of the county.

The surface of the type is level or gently undulating, and the natural drainage is good. The soil occurs as a terrace formation and is of alluvial origin. It is well above the present flood plain.

The original forest growth was mainly oak, maple, and hickory. Nearly all this has been removed and the land put under cultivation. It is now highly improved. In the area near Brooklyn corn yields 35 to 45 bushels, oats 30 to 45 bushels, barley 30 to 40 bushels, and hay 1½ to 2 tons per acre. Other portions of the type are of nearly equal value for crop production. The rotation usually followed consists of corn, followed by small grain for two years, and then timothy and clover. The soil is easy to cultivate and a mellow seed bed can be obtained without difficulty.

In the improvement of the type it is necessary to correct its acidity, and this may be done by applying ground limestone at the rate of 1,500 to 2,000 pounds per acre. Where the acidity has been corrected and the soil inoculated alfalfa can be successfully grown, and this is a valuable crop for this type. The trucking industry offers good opportunities, especially in the area near Brooklyn, where shipping facilities are particularly good.

Land of the Fox loam type near Brooklyn is valued at $125 to $135 an acre. Elsewhere it has a somewhat lower value.

The results of mechanical analyses of samples of the soil and subsoil of this type are given in the following table:

Mechanical analyses of Fox loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
311861	Soil	0.4	6.8	13.8	25.9	4.0	38.4	10.6
311862	Subsoil	1.0	5.6	11.6	25.6	3.8	31.7	20.5

FOX SILT LOAM.

The soil of the Fox silt loam to an average depth of about 12 inches consists of a light-brown or grayish, friable silt loam, which

has a whitish or ashen appearance when dry and contains only a small quantity of organic matter. The content of silt is very high, and the material has an extremely smooth, loesslike feel. The upper subsoil consists of a yellowish-brown silt loam which contains in places a small quantity of fine sand. At about 18 to 20 inches the color becomes a pale yellow and the texture is usually slightly heavier. In the lower subsoil, at about 30 inches, the material frequently has a drab or mottled color, indicating that the drainage is somewhat deficient. The entire type is apparently underlain by beds of stratified fine sand, but such material is seldom encountered within the 3-foot section. In a few small areas the fine sand is encountered at about 2 feet, but this is exceptional. Litmus-paper tests indicate that the soil is not usually acid.

A light phase of this type is encountered in an area of about a square mile immediately northwest of Brooklyn. The surface soil consists of brown loam carrying a rather high percentage of silt and slightly more organic matter than the typical soil. The subsoil differs from that of the main type in that it consists of a gritty clay loam or a sandy clay loam. Small rock fragments about the size of a pea are common. A bed of fine sand and gravel may be encountered within the 3-foot section, and this phase, as well as the remainder of the type, is underlain by stratified beds of sand and gravel.

The type is of moderately large extent and is distributed throughout various sections of the glaciated part of the county. It is developed along the north shore of Lake Mendota, in outwash plains or valley fills near Springfield Corners, and in the northwestern and south-central parts of the county. The type also occurs in small areas throughout the southeastern part of the county, and in many of these areas the surface soil carries an appreciable quantity of fine sand and very fine sand.

The surface of the Fox silt loam is level to very gently undulating and the natural drainage is frequently poor. The type is so situated, however, that it could all be readily tile-drained. The light phase has better natural drainage than the main type.

The material composing the Fox silt loam occurs as outwash plains or old valley fill, and was all deposited by water, chiefly by streams issuing from the glacial ice sheet. The parent material is glacial débris which was mainly ground from the underlying limestone of the region. While the soil has been considerably leached since its first deposition, there are still varying quantities of carbonate of lime in the material, which tend to prevent the development of an acid condition.

The original forest growth consisted chiefly of elm, ash, hickory, and oak. Practically all of this has been removed.

The greater part of this soil is under cultivation, and general farming is the chief type of agriculture. Where the drainage conditions are best, yields average about the same as on the Miami silt loam, with which this soil is often associated. Corn, oats, barley, clover, and timothy are the general farm crops grown, and as this soil occurs in small tracts, and usually forms parts of fields where the Miami silt loam is the predominating type, the methods of cultivation, crop rotation, and fertilization are practically the same as those practiced on that soil.

For the improvement of the main type the establishment of tile drainage is necessary. As is the case with the Miami silt loam, the organic-matter content is low, and the type requires the addition of stable and green manures.

The value of farms on this soil ranges from $60 to $150 an acre, depending upon the condition of the land, improvements, location, etc.

Plainfield Series.

The surface soils of the Plainfield series range from brown to grayish yellow; the subsoils are yellow to pale yellow. This series is developed in the deep drift-covered areas of Wisconsin, Michigan, and Minnesota, and comprises soils formed from sandy and gravelly glacial débris washed out from the fronts of the glaciers. It is also developed as deep filled-in valleys along major and minor streams like the Manistee and Au Sable Rivers in Michigan, and the Wisconsin River in Wisconsin. The first phase occurs as nearly level or gently sloping outwash aprons connected with terminal moraines, while the second is formed by the filling in of valleys, often several miles in width, during periods of former glaciation. Upon the flat floors of some of these valleys moraines of the later ice sheets have been deposited, leaving intermorainic exposures in the form of level plains. The greater part of the material of the series has been considerably assorted by voluminous glacial waters, and consists mainly of sand and gravel. The deposits are deep and the soils leachy and droughty. This series is represented in Dane County by a single type, the Plainfield fine sand.

PLAINFIELD FINE SAND.

The surface soil of the Plainfield fine sand has an average depth of about 10 inches. It consists of a brown or light-brown fine sand, which contains only a small quantity of organic matter, except bordering marshes where there is a darker color and a larger content of vegetable matter than typical. The subsoil consists of a fine sand, which frequently has a slightly reddish tinge in the upper part, but grades into light yellow with increased depth. Below 2 feet the

texture is sometimes coarser, and in the lower depths the material is stratified. Both soil and subsoil have a loose, open structure, and in places the surface soil has been influenced somewhat by wind action. Litmus-paper tests indicate that the soil is slightly acid.

A coarse phase of this type is encountered in a small area about 3 miles north of Stoughton and on the high terrace of Lake Kegonsa. The surface soil of this phase consists of a loose, open sand of yellowish-gray color, and is underlain by a yellow sand which becomes coarser with depth. The surface has been influenced by wind action, as is the case with the typical soil. If this phase were of sufficient extent it would be mapped separately as the Plainfield sand.

The Plainfield fine sand is of small extent, and is confined chiefly to the valley of the Wisconsin River north of Mazomanie. A few small areas occur in other parts of the glaciated section of the county.

The surface of the type is level to gently undulating. The variations are due to the action of wind. The drainage is usually good, except bordering marshes, where it may be somewhat deficient. On the minor elevations the drainage is excessive and the soil is droughty.

The Plainfield fine sand is of alluvial origin, and consists chiefly of terrace material. It is elevated above the present flood plain, and is not subject to overflow. While the parent material was in part derived from glacial débris from a limestone region, the soil has weathered to such an extent that there is not sufficient carbonate of lime present to influence its agricultural value.

The original timber growth consisted chiefly of oak, poplar, sycamore, elm, ash, and willow. The greater part of this has been removed.

About half of this type is under cultivation, and it is devoted mainly to general farming. Corn yields about 25 bushels, oats 20 bushels, and rye 15 bushels per acre. Some potatoes are grown, but not on a commercial scale. Clover does not do well, and the type is considered of rather low value. No definite crop rotation is followed, and in general it may be said that the methods of farming practiced are inferior to those on the better soils of the county.

The type is deficient in organic matter and requires the use of stable manure and green-manuring crops. The application of peat is beneficial, particularly where supplemented with commercial fertilizers containing potash and phosphoric acid, in which elements the peat is deficient. Ground limestone is effective in correcting the acidity, and where it is used clover may be grown. Where a good stand of clover is secured it increases the productiveness of the soil.

Land of this type has a value of $15 to $50 an acre, depending largely upon the location and improvements.

Waukesha Series.

The surface soils of the Waukesha series are dark brown to black and the subsoils are yellow. These soils occur in areas of deep glacial drift. They are derived from water-assorted glacial débris deposited in broad filled-in valleys or as outwash plains and terraces. The topography is mainly flat to undulating. Drainage is good. The Waukesha fine sandy loam and silt loam, each with a low-terrace phase, are mapped in Dane County.

WAUKESHA FINE SANDY LOAM.

The surface soil of the Waukesha fine sandy loam has an average depth of 12 to 14 inches, and consists of a dark-brown or almost black fine sandy loam containing a comparatively high percentage of organic matter. The subsoil becomes lighter in color with depth and is usually yellowish brown at about 24 inches. In texture the subsoil is generally a fine sandy loam grading into stratified sand and gravel at about 36 inches. This lighter material frequently has a slightly reddish tinge. Variations are common in both soil and subsoil, and small patches of fine sand, loam, and even silt loam are scattered through areas of this soil. These variations, however, are too inextensive to be indicated on the soil map. Along Sugar River and in the vicinity of Bass Lake the soil of this type is heavier than typical, and might be considered a heavy fine sandy loam.

A heavy phase of the Waukesha fine sandy loam is found, but not mapped, in which the soil approaches a loam in texture. The subsoil is usually a fine sandy loam. This phase occurs in Halfway Prairie Creek Valley, and also south of Paoli. Litmus-paper tests indicate that the soil is strongly acid.

The total area of the Waukesha fine sandy loam with its phases is 12.4 square miles. It occurs in small areas in the valley of Halfway Prairie Creek, along Sugar River, in the vicinity of Bass Lake, and also in the valley of the Wisconsin River at and north of Mazomanie.

The surface of the type is level or has a very gentle slope toward the stream along which it occurs. On account of the character of the soil and the underlying sand and gravel, the natural drainage is good.

In origin the type is alluvial. It consists of outwash or stream-terrace material. The parent material was largely from glaciated limestone regions, but has been acted upon by water to such an extent that practically all of the carbonate of lime has been removed from the surface. There is some limestone gravel in the deep subsoil, but this appears to have little if any effect upon the agricultural value of the type. The moist conditions which prevailed over the type favored the growth of a rank vegetation, chiefly grass, and the growth and decay of this accounts for the dark color and the high organic-matter content.

Much of this type was in a prairie or semiprairie condition, and the chief growth consisted of grasses, with a scattered stand of timber.

Practically all the type is under cultivation and it is devoted to general farming in conjunction with dairying. Corn yields 30 to 40 bushels, oats 30 to 45 bushels, barley about 30 bushels, hay about 1½ tons, and potatoes about 125 bushels per acre. Some tobacco is grown north of Bass Lake on this soil and very good yields are obtained. The rotations followed are practically the same as on the Waukesha silt loam, and aside from drainage the methods of improvement needed on that type are applicable to this soil.

Waukesha fine sandy loam, low-terrace phase.—The surface soil of the low-terrace phase of the Waukesha fine sandy loam consists of a fine sandy loam of a dark-brown color and extending to a depth of about 8 inches. There is frequently a surface covering of a few inches of sandy, mucky material in which the percentage of organic matter is very high. The subsoil consists of a grayish fine sand which extends to a depth of over 3 feet. In a few places the surface soil is a dark-brown or nearly black fine sand without the covering of mucky material. Litmus-paper tests indicate that the soil is quite strongly acid. This phase differs from the main type principally in the absence of limestone material and gravel from the deep subsoil.

The surface is level. Owing to the open character of the material the natural drainage is usually good, except where the water table is near the surface.

The phase occurs as a terrace in the valley of the Wisconsin River a few miles north of Mazomanie, and has a small total area. The soil is of alluvial origin. The dark color is due chiefly to the growth and decay of grasses.

Like the silt loam of the Waukesha series, this soil originally was in a semiprairie condition. The phase is mainly under cultivation, and most of the general farm crops common to the region are grown. The yields are lower than on the silt loam, but are usually fair. Correcting the acidity of this soil is important in its improvement.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the typical Waukesha fine sandy loam:

Mechanical analyses of Waukesha fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
311809	Soil	0.9	13.2	25.6	26.2	5.6	17.3	11.4
311810	Subsoil	.8	15.2	26.0	25.4	6.0	16.3	10.3

WAUKESHA SILT LOAM.

The soil of the Waukesha silt loam to an average depth of 10 inches consists of a dark-brown to black friable silt loam which contains a high percentage of organic matter. The content of silt is high and the material has a very smooth feel. The upper subsoil consists of a dark-brown silt loam which contains an appreciable amount of fine sand. At about 16 inches the color is brown. Below this depth the material is a yellowish-brown silt loam to a depth of 4 to 6 feet, where stratified beds of sand and gravel are encountered. The lower part of the subsoil is frequently drab or yellowish in color and contains some fine sand.

The most marked variation in this type occurs between Oak Hall and Oregon, where the underlying beds of sand and gravel are within 2 feet of the surface in a few small areas. The surface soil in such places contains more fine sand than typical, but not enough for the material to be classed as a fine sandy loam. Litmus-paper tests indicate that the entire type is quite strongly acidulent.

The main occurrence of the Waukesha silt loam is in the valley of Black Earth Creek, where it is found on what appears to be a second bottom. Throughout the southeastern part of the county there are a number of smaller areas. Tracts more extensive than these occur to the north of Oregon and to the east and west of Verona. Other patches are encountered on the high terrace about Lake Kegonsa, on the terraces along Koshkonong Creek, and in the outwash plains in Rutland Township.

The surface of the type is level to very gently undulating, and there is sometimes a very gentle slope toward the stream or body of water along which it is developed. The natural drainage is usually fair, but there are a number of places where it is somewhat deficient.

The main part of this type, in the valley of Black Earth Creek, is said by geologists to be an outwash plain. Most of the course of this stream is outside the glaciated region, but the material forming the soil was carried beyond the glacial border by the rushing waters from beneath the ice sheet. In other parts of the county the type occupies outwash plains, lake terraces, and stream terraces. In one place along Sugar River the soil is comparable with the Clyde silt loam in every respect, except that it occupies the second bottom. The section profile is practically the same as the Clyde in this locality. The parent material is from the glaciated limestone region, and some of the gravel in the deep subsoil consists of limestone. The surface of the entire type, however, is in an acid condition. After its first deposition the moist conditions which prevailed favored a rank growth of vegetation, and the growth and

decay of this accounts for the dark color and high organic-matter content of the soil.

A part of this type was prairie land, and prairie grasses constituted the chief growth. There was some timber, consisting chiefly of oak, some elm, ash, and soft maple, where the drainage was deficient.

Nearly all the Waukesha silt loam is under cultivation and in a high state of productiveness. The greater part of the type is devoted to general farming. Corn yields 40 to 70 bushels, oats 40 to 65 bushels, barley 35 to 45 bushels, and timothy and clover mixed 1½ to 2 tons of hay per acre. In the southeastern section considerable tobacco is grown on this soil, and yields of 1,200 to 1,800 pounds per acre are obtained. It is considered one of the most desirable tobacco soils in that region. The type is well suited to cabbage and sugar beets, and, with the use of lime, to alfalfa.

The most common rotation of crops followed consists of corn, small grain, and hay. Corn is sometimes grown on the same field for two or three years in succession. This is an excellent corn soil, but the quality of the small grains is not so good as is produced on the light-colored silt loam soils of the county.

Because of the high organic-matter and silt content, the soil works up readily under favorable moisture conditions into a good seed bed. An improvement in the subdrainage would make the soil warm up earlier in the spring, and permit work to be undertaken on the fields somewhat earlier, and it is probable that tile drains could be profitably installed over the greater part of the type, although their use is not essential to the profitable production of crops. The increased profits resulting from tiling, it is thought, would easily pay for the improvement within a few years.

The acidity of the type is readily corrected by the application of ground limestone at the rate of about 1,500 to 2,000 pounds per acre. The type is well suited to cabbage and sugar beets, and, with the use of lime, to alfalfa.

The value of land of this type usually ranges from $100 to $200 an acre. Where tobacco is grown, small tracts are held at about $300 per acre.

Waukesha silt loam, low-terrace phase.—The soil of the low-terrace phase of the Waukesha silt loam to an average depth of 12 inches consists of a dark-brown to black silt loam, which is high in organic matter. The subsoil consists of a yellowish-brown silt loam, containing a rather high percentage of fine sand, and grading into a grayish fine sand below 2 feet. The material forming the deep subsoil is stratified and the structure is loose and open. Both soil and subsoil are subject to considerable variation, but as a whole the phase

corresponds very closely to that part of the Waukesha silt loam in which the underlying sand lies within 2 feet of the surface. Litmus-paper tests indicate that the soil is very acid.

The phase has an area of less than a square mile in this county and is confined to the Wisconsin River Valley, a few miles north of Mazomanie. The surface is flat, but the natural drainage is fair.

The material from which this soil is derived occurs as a second bottom and is of alluvial origin. The parent material is from the glaciated region. It was carried down when large volumes of water flowed from beneath the ice sheet, and deposited within what was then the flood plain of the river. With the recession of the ice, the stream cut a deeper channel, leaving this soil on a terrace above the present flood plain.

The phase originally supported a thick growth of grasses and only a scattering of timber. The greater part of the soil is under cultivation, and profitable yields of the general farm crops are obtained.

Clyde Series.

The soils of the Clyde series are dark brown to black in color, overlying gray, drab, or mottled gray and yellowish subsoils. They have been formed in lakes, ponds, or low, poorly drained areas within glaciated regions through the influence of poor drainage and the accumulation of organic matter acting on the original glacial till of the basins or on accumulations of water-laid material washed into and deposited on the floor of the basins. Three members of this series, the Clyde fine sandy loam, loam, and silt loam, are recognized in Dane County.

CLYDE FINE SANDY LOAM.

The surface soil of the Clyde fine sandy loam consists of a black or dark-brown fine sandy loam, ranging in a few places to a fine sand. It has an average depth of 12 inches. The percentage of organic matter present is high, and there is frequently a mantle of 2 to 6 inches of peaty material over the surface. When the type is brought under cultivation this peaty material becomes mixed with the soil. The subsoil consists of a fine sandy loam much lighter in color than the soil, usually being drab or grayish. This material frequently becomes somewhat heavier with depth, until at about 30 inches it is a silty clay loam mottled with yellow and brownish iron stains. The subsoil, however, is variable, and frequently consists of fine sand or fine sandy loam of a white or grayish color. Litmus-paper tests indicate that this soil is acidulent in only a few places.

The Clyde fine sandy loam is confined to the glaciated section of the county and is of limited extent. An area to the north of Middleton occupies an old lake bed. Small areas occur in the vicinity

of Fish and Crystal Lakes, and other patches are scattered throughout the northern and southeastern parts of the county.

The type lies low and flat, and the natural drainage is deficient. Along the margin of some of the areas the type is high enough for crops to be grown without artificial drainage, but over most of it tile drains or open ditches are necessary for the profitable production of general farm crops.

The Clyde fine sandy loam occurs in old lake beds, ponded valleys, and along the valleys of present streams. It is of alluvial and lacustrine origin, having been washed down from the higher country adjoining and deposited in lakes or stream flood plains. The moist conditions favored a rank growth of grasses and water-loving plants, the decay of which accounts for the dark color and the high organic-matter content of the soil.

The original forest growth on this soil consisted of elm, soft maple, ash, and willow. Most of the type is still forested, but there is little timber of value.

This soil has not been improved and put under cultivation, and its chief use at present is for pasture and the production of marsh hay. It furnishes good grazing for the greater part of the season and can be used to advantage for this purpose, especially where dairying is carried on. The Clyde fine sandy loam is in need of drainage. Where properly drained it is adapted to corn, timothy, alsike clover, and small grains. It is not capable of producing small grain of as good quality as that grown on the light-colored upland soils, but profitable crops can be had. The soil appears to be somewhat deficient in potash and phosphorus. Stable manure is not used to best advantage on this soil, since it is not in need of the nitrogen of the manure.

CLYDE LOAM.

The Clyde loam is an extremely variable soil, but there are a few characteristics which are uniform throughout its development. The type averages a black or dark-brown loam to a depth of about 10 to 12 inches. This is underlain by a dark-brown, drab, or bluish fine sandy loam or sandy clay loam, which usually grades into a fine sand at lower depths. The subsoil is usually mottled with yellow or brown iron stains. The texture of both soil and subsoil varies, but the surface is always dark, and the underlying material is always considerably lighter in color. The mottled condition is quite uniform. Litmus-paper tests indicate that the soil is seldom in an acid condition.

The Clyde loam is of very limited extent, and only a few small patches are mapped. One of these lies 1 mile west of Brooklyn and another about 2 miles northwest of the same place. Other small

tracts are encountered in various parts of the glaciated section of the county.

The surface of the Clyde loam is level, and the natural drainage is poor. Before profitable yields can be had it is necessary to construct tile drains or open ditches.

The material composing the type is of alluvial or lacustrine origin, and has been washed down from the higher adjoining soils and deposited in small lakes or streams. One of the areas mapped lies just outside of the moraine in a region of outwash material. The dark color and high organic-matter content are due to the decay of a rank vegetation, the growth of which was favored by moist conditions. The type occurs in a limestone region, and the wash from the uplands tends to correct any acid condition which might otherwise develop.

The original forest growth included elm, soft maple, ash, and willow. Although the greater part of the type is still uncleared, the present timber is of little value.

The type is utilized for grazing, but is too wet for cultivated crops. Where reclaimed by drainage it is adapted to the same crops as the Clyde silt loam, and requires the same treatment as that type.

CLYDE SILT LOAM.

The soil of the Clyde silt loam to an average depth of 14 inches consists of a black or dark-brown silt loam which contains a very large percentage of organic matter. The surface is frequently covered with a mantle of peaty material 1 to 6 or 8 inches in thickness, but where the land is cleared and cultivated this becomes incorporated with the soil. The subsoil consists of a drab or bluish silt loam which grades into a silty clay loam at about 20 inches. This material extends to a depth of over 3 feet, and throughout the subsoil, especially in the lower part, yellow mottlings or stains are usually found. In a few places along the Yahara River and Koshkonong Creek the black silt loam was deposited over fine sandy loam or fine sand. The black silt loam is also found over peat in a few instances. Such variations, however, are of only small extent. The type as a whole is quite uniform. Litmus-paper tests indicate that the soil is not acid.

The Clyde silt loam is confined to the glaciated section of the county, throughout which it is exceptionally widely distributed. The total area mapped is large, but there are few tracts over 1 square mile in extent. In Medina and York Townships the type occurs as long, narrow belts bordering areas of Peat, while in other places it frequently occupies the entire extent of a low, poorly drained depression.

The surface of this type is level, and the natural drainage is poor. Before cultivated crops can be profitably grown, open ditches or tile

drains must be installed to carry off the excess water. There is usually some fall, so that most of the areas of this soil can be successfully drained.

The Clyde silt loam is largely of lacustrine and alluvial origin. It occurs as old lake beds, ponded valleys, kettle basins, and old sloughs. It also occupies the valleys of present streams. The parent material was doubtless derived from wash from the upland regions, and was either deposited in the quiet waters of lakes or by slowly moving streams. The moist conditions which prevailed favored a rank growth of vegetation, the decay of which accounts for the dark color and high organic-matter content of the soil.

The original forest growth consisted of ash, elm, soft maple, and willow. Most of the merchantable timber has been removed, but only a small part of the type has been cleared. Where open ditches and tiles have been installed some of the largest crops of the region have been produced on this soil. Corn has yielded as much as 80 bushels per acre and oats 92 bushels. Grass makes a very rank growth, and timothy yields 2 tons of hay per acre. Alsike clover also does well. Small grains are likely to lodge, and the quality of the grain is not quite equal to that produced upon the light-colored silt loam soils of the county. Small grains can be produced with profit, however, and may well form a part of the crop rotation. Sugar beets yield 12 to 18 tons per acre, and while the sugar content is not as high as on the light-colored silt loam soils, the yield is greater and the net returns are larger. Cabbage can be grown successfully on the Clyde silt loam, but peas produce too rank a growth of vines.

The greatest need of the Clyde silt loam is drainage. It is estimated that the cost of tiling would be $25 or $35 an acre. The soil is apparently somewhat deficient in potash and phosphorus. It is well supplied with nitrogen, and the best practice is to use the stable manure on the upland soils and apply commercial fertilizers on this type.

Union Series.

The soils of the Union series are brown to grayish brown, and the subsoils prevailingly yellowish brown. These soils are characteristically developed in the northeastern part of the Ozark Plateau. They resemble loessial soils in their development near the Missouri River. The origin of the soil material is not thoroughly understood. It is possible that the uniform brown, friable silt loam is of loessial origin. The sand unquestionably is derived from sandstone, and limestone probably enters into the composition, especially where the subsoils are heavier. The subsoil material is probably largely residual from limestone and sandstone. The topography is gently rolling to

hilly and the steeper slopes are subject to erosion. Drainage is good. Only one member of this series is recognized in Dane County, the Union silt loam.

UNION SILT LOAM.

The surface soil of the Union silt loam has an average depth of 12 inches and consists of a light-brown or grayish silt loam, with a very smooth feel and containing only comparatively small quantities of organic matter. The material is friable and loesslike, and tests with litmus paper indicate that it is slightly acid in places. The subsoil consists of a yellowish-brown heavy silt loam. It gradually becomes heavier in texture with depth, and is a compact silty clay loam at about 18 inches. Material of this texture or heavier extends to a depth of more than 3 feet. Below 30 inches the subsoil frequently is slightly mottled. Both soil and subsoil of the typical Union silt loam are free from all coarse material such as coarse sand, gravel, or stones, and the texture of the soil, as compared with that of glacial soils, is very uniform.

The variations which occur in the Union silt loam are in the depth of the material and in topography, rather than in the texture of the loesslike material composing the greater part of the soil. The greatest variation is in topography, and a steep phase of this type is mapped separately. Another variation which is not indicated on the map is in depth to the underlying rock or to the residual material derived from the underlying rock. Usually the mantle of loesslike material has a thickness of 6 to 10 feet, but there are places where the underlying material is within reach of the 3-foot auger, and in a few localities it is within 1 foot of the surface over small areas. The underlying rock is usually limestone, and where the residual material from this source forms a part of the subsoil it consists of a yellowish-red or a red clay loam or clay. Immediately over the rock the material may be variegated, red, brown, yellow, and drab being common. Where the rock is near the surface limestone fragments and some cherty material are encountered in the subsoil and in a few cases on the surface. Where the underlying rock is sandstone, as is sometimes the case, the deep subsoil is sandy, and sand is more or less mixed with the loessial material. As bedrock is approached in such places the fine sand is more abundant. Such areas, however, are comparatively inextensive. This type includes the light-colored silt loam in the region of the pre-Wisconsin drift sheet in the south-central part of the county. With the exception of a few small isolated spots where the old glacial drift enters into the formation of the soil, there is no difference between this material and the typical Union silt loam. The silty loesslike covering extends over the old drift as well as over the driftless area.

The occurrence of a few crystalline bowlders is the only indication of glaciation found in this type.

A variation in the color of the Union silt loam occurs where this type borders the Dodgeville silt loam, which is black. In such places the surface soil has a darker color than typical, and the upper subsoil is sometimes darker than usual, while the lower section of the subsoil is the same as in other parts of the type.

The texture and color of the Union silt loam are very similar to those of the deep phase of the Miami silt loam. The texture is also similar to that of the Dodgeville silt loam and Carrington silt loam, deep phase, but both of these are dark in color and are prairie soils, while the Union is light colored and is forested.

The Union silt loam is confined chiefly to the unglaciated part of Dane County, in the western and southwestern sections. Throughout this region this soil, with its steep phase, is the predominating type. The typical soil occupies the tops of ridges and gentle slopes, while the steep phase is found along the steep hillsides and narrow ridge tops. Associated with this soil are numerous areas of Rough stony land, where the surface is very steep and where rock outcrops are common on the valley walls.

The topography of the typical soil varies from undulating to gently rolling and rolling, but the surface is not so steep as to prevent the use of efficient farm machinery. Where the slope is too steep for cultivation with modern farm machinery, it is mapped with the steep phase. The most nearly level areas are confined to the broad ridge tops. Where the ridges are narrow the surface is more broken, and the slopes grade into the steep phase. The natural surface drainage is good. Only on the nearly level ridge tops, which are of comparatively small extent, would tile drains be found profitable. The subsoil is heavy and compact, and the movement of water through the soil section is not as free as where there is some coarse material mixed with the subsoil, as is usually the case in the glaciated soils. Where the bedrock is near the surface the soil may be somewhat droughty. The material composing this soil erodes readily, and when slopes are left bare ditches and ravines are formed rapidly. It is difficult to check the development of these ditches, and the better practice is to keep the steeper slopes covered with a growing crop to prevent erosion.

This soil probably is derived largely from the weathering of the limestone which underlies the type at depths of 3 feet or more. Where limestone is the underlying rock the subsoil is usually heavy and of reddish or brownish color, while where the type is derived from sandstone the subsoil is sandy.

The original forest growth consisted of white, bur, and black oaks, with some maple, poplar, hickory, birch, and basswood. All of the

type was originally forested, but the timber remaining is largely confined to the steep phase, with a few woodlots on the main type.

By far the greater part of the typical soil is under cultivation, and some of the steeper slopes are kept in permanent pastures or woodlots. The type of agriculture followed most extensively consists of general farming in conjunction with dairying. The tendency seems to be toward the extension of the dairy industry. Many silos and new barns are being constructed and cheese factories are numerous, especially between the south county line and the region around Black Earth and Mazomanie. Although no systematic rotation of crops has been generally adopted for this soil, an increasing number of farmers are giving this matter careful attention. A rotation which is quite common consists of corn one year, followed by a small-grain crop for one or two years. The small grain is usually oats or barley, although some wheat is still grown. With the last grain crop clover and timothy are seeded and hay is usually cut for two years before the field is again plowed for corn. Because of the amount of steep land in permanent pasture associated with this soil, the cultivated portion of the farm is usually not pastured. Stable manure is usually applied to sod to be plowed for corn. The supply of this, however, is usually inadequate, so that the farm can not be completely covered oftener than once in eight or nine years.

Corn produces about 40 bushels, oats 35 bushels, barley 30 bushels, wheat 15 bushels, and timothy and clover mixed about 1½ tons of hay per acre. The farmers who manure well, plow deeply, and give more attention to thorough cultivation than the average obtain yields considerably higher than these. Some tobacco is grown on this soil, but the acreage is small and interest in the crop seems to be declining. Potatoes are grown only for home use, and berries and small fruits receive but little attention outside of the home garden. Nearly every farm has a small apple orchard, but apples are not produced on a commercial scale. Dairying is an important industry on this type.

The soil of this type is easily cultivated, but it can not be worked under so wide a range of moisture conditions as the lighter textured soils of the county. If plowed when too wet it is likely to puddle, but if handled under the most favorable conditions a mellow seed bed is readily worked up. Where the soil is shallow, as on some of the slopes and ridge tops, the underlying heavy subsoil may be turned up with the plow. In such places more difficulty is experienced in cultivation, because of the heavy nature of the material and the presence of rock fragments in places. On the steeper slopes it is necessary in the cultivation to consider the danger of erosion. Where this is most pronounced a good practice is to plow the land in strips following the contour of the hill, leaving strips of sod between the plowed areas. Where the slope is more gentle, simply plowing with

the contour is sufficient. On some of the slopes shallow sod ditches are left to carry the surface water and the land is cultivated between these, the ditches being so shallow that they can be driven over readily.

The supply of organic matter is low. It may be increased by supplementing the stable manure with green-manuring crops, preferably the legumes. Where the soil is in an acid condition the use of ground limestone or some other form of lime is beneficial. Alfalfa is a valuable crop, especially where dairying is practiced, and does well where the soil is limed and inoculated.

Union silt loam, steep phase.—The soil of the steep phase of the Union silt loam usually resembles that of the main type, but is subject to more variation and forms a thinner covering over the underlying rock. The surface soil is usually a light-brown silt loam to a depth of about 10 inches. This is underlain by a yellowish-brown silty clay loam which usually extends to a depth below the reach of the 3-foot auger. In many places erosion has removed the surface covering and the heavy silty clay loam forms the surface soil. In other places, especially where the soil is shallow, rock fragments are mixed with the soil. Over sandstone there is frequently considerable fine sand incorporated with the soil section, and the deep subsoil may consist of a fine sand or fine sandy loam. Where limestone is the underlying rock the subsoil is frequently a red or reddish-brown, residual, heavy clay loam containing cherty fragments. Rock outcrops occur in a few places on this phase.

The Union silt loam, steep phase, is confined to the unglaciated part of the county, and is closely associated with the typical Union silt loam. It is not as important as the main type, but forms a part of nearly all the farms containing the latter and has considerable influence in determining the type of agriculture followed.

The steep phase has a rolling to hilly surface, and comprises steep slopes and sharp, narrow ridges over which the grade is sufficient to prevent or greatly interfere with the use of modern farm machinery, and where the danger from erosion is so great that intertilled crops can seldom be grown with safety. Great care in cultivation is necessary to prevent the soil from washing and to prevent large side-hill ditches and ravines from forming.

The steep phase has the same derivation as the typical soil, but usually the underlying rock is nearer the surface.

The original forest growth consisted of several varieties of oak, maple, hickory, birch, and basswood. Practically all of the merchantable timber has been removed. In places there is a second growth in which hazel brush is common.

Only a small part of the steep phase is under cultivation. Most of it is still forested, and where the timber has been partially or com-

pletely removed the land is generally in permanent pasture. The timbered areas are best kept forested.

As a whole the soil of the steep phase is somewhat less productive than the main type, but if the surface were less broken it would be considered a fair agricultural soil. Associated with the steep phase are areas of Rough stony land, and these, together with the steep slopes, tend to reduce the value of tracts of typical Union silt loam with which they are associated. Farmers estimate that from May 15 to October 15 the steep phase provides good pasturage at the rate of 5 acres to a cow, while on the typical soil 3 acres to an animal are considered sufficient. This phase may be profitably used on all dairy farms as grazing land.

Dodgeville Series.

The soils of the Dodgeville series are dark brown to almost black. The subsoils are light reddish brown, buff, or brown. The members of this series are of residual origin and derived from limestone, with a slight admixture of loessial material. It is usually difficult to detect the loess on account of its extreme thinness where present, and because of the fact that the texture is essentially the same as that of the residual material from limestone. The topography is rolling to somewhat hilly. The soil is thin in places, the underlying rock being encountered at a depth of 3 feet or possibly less, though in general the soil covering is much thicker. Two types of the Dodgeville series, the fine sandy loam and silt loam, are encountered in Dane County.

Dodgeville fine sandy loam.

The soil of the Dodgeville fine sandy loam to an average depth of about 10 inches consists of a dark-brown or almost black fine sandy loam or fine sand, which is high in organic matter and frequently carries a considerable quantity of silt. Fragments of chert and limestone are common, and sometimes interfere with cultivation. The subsoil consists of a lighter colored fine sandy loam, with a small percentage of clay. Limestone fragments and chert are abundant and the bedrock is usually encountered at depths of 1 to 2 feet. Outcrops of the underlying rock are very common. Litmus-paper tests indicate that the soil is in a pronounced acid condition.

The type occurs only in isolated patches associated with the Dodgeville silt loam, and is of very small extent. Small tracts are encountered about 6 miles southeast of Perry, and about 3½ miles northwest of Belleville. It occupies rocky ridges, some of which are nearly rough enough to be classed as Rough stony land. The natural drainage is excessive, and the type is droughty.

This soil is mainly of residual origin, and derived largely from the underlying limestone, which is quite cherty.

The type originally supported a scattered forest growth, and was in a semiprairie condition. The silt loam, with which it is associated, is a typical prairie soil.

Because of the rocky, shallow, and droughty nature of this soil it can be used only for grazing, with the exception of a few small areas where the soil is deeper than usual, and where there are fewer rock fragments and outcrops. The type as a whole has a very low value.

The results of mechanical analyses of samples of the soil and subsoil of this type are given in the following table:

Mechanical analyses of Dodgeville fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
311871	Soil	0.2	0.4	5.0	36.3	11.1	37.1	9.8
311872	Subsoil	.1	.4	4.2	36.7	12.8	34.9	11.0

DODGEVILLE SILT LOAM.

The surface soil of the Dodgeville silt loam has an average depth of 12 inches. It consists of a black or dark-brown silt loam with a relatively high percentage of organic matter. The soil is friable, the material is free from all coarse particles such as coarse sand, gravel, or stones, and the texture is remarkably uniform. The subsoil consists of a yellowish-brown heavy silt loam which grades into a silty clay loam at about 20 inches. Below this depth the color is a more pronounced yellow. The average depth to the underlying limestone rock is about 4 feet, but outcrops on hillsides are quite common. Where the depth is less than 4 feet, the subsoil frequently has a reddish or yellowish-brown color, due to the presence of material derived from the weathering of the limestone. With this residual part of the subsoil there may be a few rock fragments which have resisted weathering. The portion of this type within the area covered by the pre-Wisconsin ice sheet does not differ from the remainder, except that a few crystalline bowlders may be found upon the surface. Litmus-paper tests indicate that the soil is in an acid condition.

The Dodgeville silt loam is confined to the prairie regions of the unglaciated section of the county, in the southwestern part. It has a total area of 51 square miles, and is one of the important soils of the region. It is very similiar to the Carrington silt loam in color, texture, and agricultural value, but is confined to the driftless region, while the Carrington occurs in the glaciated section.

The surface varies from gently undulating to rolling, though the greater part of the type comprises gently rolling prairie land. The natural drainage is usually well established, but on some of the more gentle slopes it is probable that tile drains might be installed to advantage. On the steeper slopes there is some damage from erosion, but this can be held in check by exercising care in cultivation and in the selection of crops.

The Dodgeville silt loam is derived mainly from the weathering of the underlying limestone. Possibly the surface material is of loessial origin. On some of the hillsides the surface material has been removed by erosion and the reddish, residual material usually found just above the limestone is exposed. This material is also frequently seen in road cuts. The small part of this type mapped in the south-central section of the county where the pre-Wisconsin glacial drift is found may differ slightly in origin from the remainder of the type. The old glacial drift appears to be very thin, and the soil is practically the same as in the driftless area. A few crystalline bowlders occur in this region, and their presence is usually the only indication of glacial action.

The Dodgeville silt loam is a prairie soil, and the native growth consisted chiefly of prairie grasses. There were a few trees on some of the steeper slopes and along the border of other types of soil.

Probably 95 per cent of this type is under cultivation, the remainder being in permanent pasture. The type of agriculture most extensively followed consists of general farming and dairying. Corn yields 40 bushels, oats 35 bushels, barley 30 bushels, wheat 15 bushels, and clover and timothy mixed about 1½ to 2 tons of hay per acre. Yields of 1,000 to 1,700 pounds of tobacco per acre are reported, but this crop is not grown as extensively as in former years. The rotation most commonly followed consists of corn, which may be grown two or three years, followed by a small-grain crop possibly for two or three years, after which the land is seeded to timothy and clover and cut for hay for at least two years. Frequently the fields are pastured for a year or more before again being plowed for corn. The tendency is to reduce the length of the rotation by growing corn for only one year, grain for about two years, and hay for only two years. Better results are obtained by such a system.

The Dodgeville silt loam is a rather heavy soil, but when cultivated under the most favorable moisture conditions little difficulty is experienced in getting a mellow seed bed. On some of the steeper slopes the heavy subsoil is exposed, and this is more difficult to handle. Barnyard manure is the only fertilizer used on this soil, and it is most frequently applied to sod which is to be plowed for corn.

The soil is in an acid condition, and before alfalfa or clover can make their best growth it is necessary to correct this condition by

applying ground limestone at the rate of about 1,500 to 2,000 pounds per acre, or some other form of lime may be used. While some alfalfa is now grown, an increase in the acreage of this crop is advantageous, especially where dairying is the chief line of agriculture. In most cases deeper plowing and more thorough cultivation are needed. With proper methods of cultivation, seed selection, and crop rotation, there seems no reason why this soil should not produce an average of about 60 bushels of corn per acre and other crops in like proportion. Dairying is growing in importance, and the number of new silos and other improvements indicates that it is a profitable industry. In connection with dairying, more hogs could be raised with profit.

Farms on the Dodgeville silt loam have a value of $75 to $125 or more an acre, depending upon location and improvements.

In the following table the results of mechanical analyses of samples of the soil and subsoil of this type are given:

Mechanical analyses of Dodgeville silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
311873	Soil	0.1	0.2	0.2	1.6	11.4	69.2	17.3
311874	Subsoil	.2	.4	.4	1.2	7.7	60.7	29.6

Crawford Series.

The surface soils of the Crawford series are dark brown to reddish brown, with reddish-brown to red subsoils. The series comprises residual limestone soils of the prairie regions. Although derived from limestone, these soils contain only a small percentage of lime, differing materially in this respect from the soils of the Houston series, which occur in the Cretaceous black prairies of the Coastal Plain. The members of the Crawford series occupy undulating or rolling country and sometimes local areas of rough, broken topography. They are generally well drained. The silt loam is the only member of the Crawford series encountered in Dane County.

Crawford silt loam.

The surface soil of the Crawford silt loam is about 10 inches deep. It consists of a dark-brown or almost black silt loam which contains a high percentage of organic matter. Large quantities of fine sand are present in the surface soil, and small fragments of chert are common.

The upper part of the subsoil is a heavy silt loam, considerably lighter in color than the surface soil. At about 16 inches this grades

into a reddish-brown clay loam containing numerous chert fragments. With increasing depth the material grades into a heavy clay loam or clay, and the chert fragments become more numerous. The usual depth to bedrock varies from 2 to 3 feet, though outcrops along the slopes are quite common. Within a few inches of the underlying rock, which consists of Trenton and Galena limestone, the material is variegated, the colors being characteristic of the decomposed rock. Small pockets of sand in the subsoil are common, and in a few small patches the surface material is a fine sandy loam. Such areas usually occur on the slopes, but are too small to be indicated on the soil map. Where large enough to be mapped the fine sandy loam is recognized.

A lighter phase of this type, covering about a square mile, occurs about 2 miles west of Verona. The soil consists of a dark-brown or black loam or heavy fine sandy loam, and the subsoil is a yellowish-brown loam or clay loam, with numerous small patches where the subsoil is a fine sandy loam. While the depth to rock may be 3 feet or more it probably averages about 2 feet, and the phase is more droughty than the typical soil. Both soil and subsoil are variable, and the value of the phase as farming land is lower than that of the main type.

This type is confined to the southwestern part of the county. It occurs in the unglaciated region, and has a total area of about 11 square miles. The greater part of the type is located in a large continuous tract east and southeast of Perry.

The topography of the Crawford silt loam varies from gently undulating to rolling. The undulating areas represent a plateaulike condition, while the rolling surface is found where streams have worked back into the type, carving valleys and leaving ridges, along the slopes of which outcrops frequently occur. The natural drainage is well established, and in some places where the soil is shallow it is somewhat excessive. On the steeper slopes there is some danger of erosion, but in most instances this has been held in check so that ravines have formed in only a few cases.

This soil is derived from the weathering of the underlying limestone, but litmus tests indicate a markedly acid condition. The dark color is doubtless due to the decay of a rank growth of grasses under moist conditions.

The Crawford silt loam is a prairie soil, and the original vegetation consisted chiefly of prairie grasses, with only a scattered growth of timber along some of the slopes and bordering forested types.

Probably about 65 per cent of this soil is under cultivation, the remainder being used chiefly as permanent pasture. The leading type of agriculture followed consists of dairying in connection with general farming. The milk is sold chiefly to cooperative cheese factories, and there are probably not as many hogs raised as might be

the case if butter were the chief product, when skim milk would be available for feeding hogs. The whey is returned from the cheese factories, but this has a lower feeding value than skim milk.

Corn yields about 35 bushels, oats 32 bushels, barley about 30 bushels, and hay 1 to 1½ tons per acre. A small acreage of wheat is grown and fair yields are obtained. Yields on the soil of the lighter phase west of Verona are lower than these. Alfalfa is not grown to any extent, but a few farmers are making an effort to get this legume started. The most common rotation followed consists of corn, followed by small grain, with which clover and timothy are seeded. As a rule the various crops are not rotated at close enough intervals. Corn frequently is grown on the same field for two or three years. This type is somewhat more difficult to cultivate than the Dodgeville silt loam, chiefly because the surface soil is shallower and the underlying heavy material is frequently turned up by the plow, especially along the slopes and on narrow ridges. Where the heavy residual material is thus exposed clods are frequently formed and these are rather difficult to pulverize. In the undulating areas of the type this difficulty is seldom encountered and the soil works up readily into a mellow seed bed.

The acidity of the soil is effectively remedied by applying 1,500 to 2,000 pounds of ground limestone per acre. After such treatment alfalfa may be grown successfully. More thorough cultivation, especially in harrowing and in the preparation of the seed bed, is needed.

Farms on the Crawford silt loam have an average value slightly lower than farms on the Dodgeville silt loam, which it closely resembles. The land sells for $60 to $100 an acre, and possibly more where the location and improvements are best. The value of the light phase is lower than that of the typical soil and ranges from $40 to $70 an acre.

La Crosse Series.

The soils of the La Crosse series are dark brown to black, and overlie brown, light-brown, or grayish subsoils, which are usually coarser in texture than the soils. These soils occur on stream terraces, in very gently undulating upland valley basins, and on adjoining colluvial slopes. They are derived from the weathering of stream-terrace and colluvial material, and from areas of nearly flat topography formed by the disintegrating and leveling action of sheet-flood erosion on very soft rocks. The material is derived from the Potsdam sandstone, the Lower Magnesian limestone, and a silty layer that has the physical characteristics of loess. The soils occur in coves and broad valley basins in the driftless region of the upper Mississippi. This series is represented in Dane County by a single type, the La Crosse silt loam,

LA CROSSE SILT LOAM.

The surface soil of the La Crosse silt loam to an average depth of about 14 inches consists of a black or dark-brown silt loam which contains a very large quantity of organic matter. The subsoil is a silt loam of drab color, mottled with iron stains. This extends to a depth of 30 to 40 inches, where a drab fine sand is encountered. In a few places the subsoil is a dark-colored carbonaceous silt loam to a depth of 20 inches, where the color becomes lighter. The depth to sand is also variable. In places it is encountered at 18 inches. Litmus-paper tests indicate that the soil is in an acid condition. In one small area, about 3½ miles northwest of Belleville, the surface soil is a fine sandy loam. The subsoil is of similar texture, but grades into a sandy clay at about 24 inches, and this into a fine sand at about 3 feet.

The La Crosse silt loam occurs mainly in the valley of the South Fork of Sugar River and one of its tributaries, 2 to 6 miles southeast of Mount Vernon. The type is of small extent and comparatively little importance.

The surface of this soil is level or has only a gentle slope toward the stream along which the type occurs. Owing to the topography and to the occurrence of a large number of springs, the natural drainage is poor. The sandy loam phase near Belleville is naturally somewhat better drained, but not sufficiently well drained for growing crops.

The forest growth was scattered and consisted chiefly of elm, ash, oak, hickory, soft maple, and willow. The best timber has been removed, and that which remains has but little value.

On account of the poor drainage but little effort has been made to cultivate this soil. Tile drainage is necessary before it can be successfully utilized for cultivated crops. With proper drainage the soil is capable of producing large and profitable yields of all the general farm crops.

Small areas of this type occur as rather narrow colluvial belts between the Wabash silt loam and the upland soils in small valleys tributary to the Black Earth Valley. These belts are seldom over one-eighth mile in width, and are frequently too narrow to be indicated on the soil map. In such areas the surface soil to an average depth of about 14 inches consists of a dark-brown to nearly black silt loam which gradually becomes lighter in color with depth, so that the lower part of the surface soil is medium brown. Below this a yellowish-brown color gradually develops and the texture becomes heavier. Below 20 inches the material is usually a heavy silt loam or a silty clay loam which extends to an undetermined depth below the reach of the 3-foot auger. Both soil and subsoil are free from all coarse material, such as coarse sand, gravel, and stones. The surface of these

areas is sloping, but it is never too steep to be cultivated, and natural drainage is good. A large part of the type in these valley areas is under cultivation, and the soil is utilized for the general farm crops, including corn, oats, barley, alfalfa, and hay.

The results of mechanical analyses of samples of the soil and subsoil of the La Crosse silt loam are given in the following table:

Mechanical analyses of La Crosse silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
311863	Soil	0.0	2.0	5.2	12.5	3.0	54.6	22.5
311864	Subsoil	.6	1.6	4.6	10.7	7.7	53.7	20.9

BOONE SERIES.

The soils of the Boone series are prevailingly light gray, with pale-yellowish to slightly reddish yellow and often mottled subsoils. A bedrock substratum is frequently encountered at a shallow depth. These soils are of residual origin, being derived from sandstones and shales, principally of Carboniferous age. The topography is rolling to steeply sloping, and the soils are usually forested. This series is closely associated with the Bates series, but differs from it in containing smaller quantities of humus and having a consequently lighter color and a lighter forest covering. The soils are often thin and unproductive. The Boone series includes two types in this county—the fine sandy loam and the loam.

BOONE FINE SANDY LOAM.

The surface soil of the Boone fine sandy loam to an average depth of about 10 inches consists of a light-brown fine sandy loam, usually containing considerable silt, but only a very small quantity of organic matter. The subsoil usually consists of a yellowish fine sandy loam. This becomes heavier with depth and at about 20 inches is usually a sandy clay. Where the soil section is deep this material extends to a depth of over 3 feet and has a somewhat reddish yellow color, but where the sandstone bedrock is within 3 feet of the surface, as is often the case, the material directly over the rock is a fine sand.

The Boone fine sandy loam is variable in both soil and subsoil, but the above description applies to the greater part of the type. The surface soil ranges from a fine sand to a loam and the subsoil from a fine sand to a clay loam. There are small patches which could be classed as a fine sand if of sufficient extent, but all of the variations are so limited in extent that they can not be satisfactorily indicated on the map.

The type has a total area of 32.9 square miles, and is widely distributed throughout the unglaciated part of the county. It is developed to some extent within the region covered by the pre-Wisconsin ice sheet in the south-central part of the county. The largest areas occur in Primrose, Oregon, and Montrose Townships. The smaller tracts usually occur as long, narrow strips along slopes beneath ledges of St. Peters sandstone, where the country is most thoroughly dissected.

The type usually occupies badly eroded, steep slopes, sharp ridges, broken stretches, or narrow benches where St. Peters sandstone is the underlying rock. The steepness of the slope in itself is often sufficient to prevent successful cultivation, though a large part of the type has a topography which will permit successful farming operations. The natural drainage is good, and frequently excessive. Where the soil is shallow and where it is lightest in texture it is inclined to be droughty. On the steep slopes there is considerable damage by erosion, and ditches and ravines have been formed in a number of places.

In origin the material composing the Boone fine sandy loam is largely residual, having been derived from the disintegrating and weathering of the St. Peters sandstone. Along the lower slopes a part of the soil is of colluvial origin. The sandiest areas are usually in the immediate vicinity of outcrops of the sandstone. The silty material present in places probably came from the adjoining loess-covered upland soil. Where the reddish-yellow color appears in the heavy portions of the subsoil it is possible that material from limestone has become incorporated with the residual material from the sandstone. In a few places where the texture is light the surface soil has been influenced slightly by wind action.

The original forest growth consisted of several varieties of oak, hickory, poplar, white birch, and basswood. Most of the merchantable timber has been removed, but a large part of the type has not been cleared.

Less than half of this soil is under cultivation. The type of agriculture followed consists of general farming. The soil is associated with the Union silt loam, and is usually farmed in conjunction with that type. The same methods of farming are followed as on the Union silt loam. Corn yields about 30 bushels, oats 30 bushels, and hay about 1 ton per acre. As this type warms up early in the spring and is well drained, it is often selected for gardens, and small fruits and truck crops do well. A large part of the Boone fine sandy loam is kept in permanent pasture. Some of the forested areas also are used as grazing land. Only the less steep and gently rolling land is suitable for other purposes than maintaining a permanent pasture.

The type is deficient in organic matter, which is effectively supplied by supplementing the stable manure with green-manuring crops, of which the legumes are best. The acid condition of the soil is corrected by applying ground limestone or some other form of lime. In cultivation it is necessary to exercise care to prevent erosion and, in places, the drifting of the soil by wind action.

The value of this land is low compared with that of the Union silt loam, and where areas of the Boone fine sandy loam are included on the same farm with the Union silt loam the selling price of the farm is usually lower than where the entire farm consists of the Union silt loam.

BOONE LOAM.

The surface soil of the Boone loam has an average depth of about 10 inches, and consists of a light-brown or grayish silt loam, which contains only a comparatively small amount of organic matter. It is underlain by a lighter colored loam or fine sandy loam, which gradually becomes heavier with depth and grades into a sandy clay at about 2 feet. This heavy material extends to a depth of 3 feet or more where the rock occurs at considerable depth, or it may grade into a fine sandy loam or fine sand where the rock is within 3 feet of the surface, as is sometimes the case. Immediately over the rock the material frequently has a mottled reddish color. The type as a whole is quite variable, but averages a loam in texture. Litmus-paper tests indicate that the soil is in an acid condition.

The Boone loam is confined to the unglaciated section of the county and it is closely associated with the Union silt loam and the Boone fine sandy loam. Its extent is small, and the individual areas are comparatively unimportant.

The surface of the type is rolling, and there is some danger of erosion on the steepest slopes. The natural drainage is good, and excessive where the rock is near the surface.

In origin the material composing the Boone loam is residual. It is derived largely from the underlying rock formations, which are limestone and sandstone. It is probable that a small part of the material has been derived from the loessial material entering into the composition of the Union silt loam. It seems probable that the sandstone has contributed most largely to its formation.

The natural timber growth consisted of several varieties of oak, hickory, basswood, birch, and some poplar. The merchantable timber has been removed, but a large part of the type is still uncleared.

About one-third of this type is under cultivation, and it is largely devoted to general farming, like the Union silt loam, with which it is associated. The steep land is used only for pasturage. Corn yields average about 30 bushels, oats 32 bushels, barley 30 bushels, and hay

about 1 ton per acre. The methods of cultivation, crop rotation, and fertilization followed are practically the same as on the Union silt loam, and the type responds to the same treatment as that soil.

Wabash Series.

The Wabash soils are prevailingly black, ranging to dark brown, and contain a high percentage of organic matter. The subsoils are drab or gray. These soils are developed in the first bottoms of streams in the Central Prairie States. They extend for long distances along the Mississippi River. The material is derived mainly from the calcareous drift material and loessial deposits of the Mississippi Basin. Two types of this series, the Wabash loam and the Wabash silt loam, are mapped in Dane County.

Wabash loam.

The material composing the Wabash loam is extremely variable, but prevailingly the soil to an average depth of 14 inches consists of a dark-brown to black loam. The subsoil usually is a drab or somewhat bluish loam or fine sandy loam, which is mottled with yellow in the lower depths. Both soil and subsoil may consist of fine sandy loam, and in one area of about 15 acres the soil is a black fine sand. A thin covering of peat occurs in places over the surface. In the lower subsoil fine gravel occurs in places. The material is not uniform over areas of any considerable extent.

The extent of this type is small. It is confined to the stream valleys in the driftless section of the county. Patches occur in Dunlap Hollow and along lower Halfway Prairie and Black Earth Creeks, also along the Sugar River 2 miles north of Belleville. This last development includes the tract of black fine sand referred to above.

The surface is low and flat, or has only a gentle slope toward the stream along which the type occurs, and the natural drainage is poor. This soil lies within present flood plains and is subject to overflow.

In origin the material is alluvial, having been carried down the adjoining slopes and deposited in the present flood plain. The moist conditions favored a rank growth of vegetation, the decay of which accounts for the dark color of the soil.

The original growth consisted chiefly of elm, ash, soft maple, willow, and grass. Most of the timber has been removed, but only small areas have been cleared.

On account of its low position, poorly drained condition, and the danger from floods this soil is used only for pasturage and to some extent for the production of marsh hay.

WABASH SILT LOAM.

The soil of the Wabash silt loam to an average depth of about 14 inches consists of a black or dark-brown silt loam containing large quantities of organic matter. It is underlain by a brownish-drab or bluish silt loam or silty clay loam which is mottled with iron stains below 18 inches. This material extends to a depth of over 3 feet, and it usually becomes heavier in texture with depth. Variations in this type are common, especially along the smaller stream bottoms, where small areas might properly be classed as Meadow. In places the surface soil is light brown, and the black silt loam is encountered a few inches below. In other localities there is a peaty covering, a few inches deep, over the silt loam. In small patches both soil and subsoil are quite sandy, but all these variations mentioned are of such limited extent that they can not be indicated on the soil map. The soil as a rule is in slightly acid condition.

The Wabash silt loam is confined to the valley bottoms of the unglaciated section of the county. Its total area, with its colluvial phase, is equivalent to more than a township, and it occurs along most of the streams in the western part of the county as long, narrow strips.

The surface of the type is level, or gently sloping toward the stream. The soil is subject to overflow and the natural drainage is poor. Before cultivated crops can be grown successfully most of the land requires tiling.

The material composing the Wabash silt loam is of alluvial origin, it having been washed from the adjoining higher land by erosion, carried by the streams and deposited within the present flood plain. A rank vegetation developed under the moist conditions, and the decay of this accounts for the dark color and the high organic-matter content of the type. In some of the narrow valleys the type is partly colluvial in origin.

The original forest growth consisted of willow, sycamore, elm, soft maple, and ash. Some of the timber is still standing, but it has little value.

As the drainage is poor and the type subject to overflow, it is not used extensively for farming. It affords good pasturage, however, and is highly prized for this purpose, as it occurs in a section where dairying is carried on extensively. In the few instances where the soil is properly drained, good yields are obtained, corn averaging as much as 60 bushels per acre. The main need of this type is drainage, and with the construction of open ditches and tile drains it should become one of the most productive soils of the county.

Wabash silt loam, colluvial phase.—The soil of the colluvial phase of the Wabash silt loam to an average depth of about 14 inches consists of a dark-brown to nearly black silt loam, which is high in organic matter. The subsoil is a yellowish-brown silt loam, which gradually becomes heavier with depth and grades into a silty clay loam at 20 to 24 inches. The silty clay loam continues to a depth of more than 3 feet. The soil is darkest where it borders the typical Wabash silt loam and becomes lighter as it grades into the Union silt loam, which is light colored. In a few small spots the soil is a fine sandy loam.

This phase is closely associated with the main type and borders the stream bottoms throughout the driftless region. Its total area is 14.4 square miles.

The phase occurs at the base of valley slopes as very narrow strips between the flood plain and the upland. The sloping surface insures good natural drainage. The slopes, however, are not steep enough to be subject to serious erosion, and modern farm machinery can be used on all parts of the phase.

In origin the material is largely colluvial, having been washed down the slopes from the higher land adjoining. In this respect it closely resembles the small valley areas of the La Crosse silt loam.

The original forest growth was chiefly elm, ash, and hickory, with some oak. All of the timber has been removed and the land cleared. The greater part of the phase is under cultivation. It gives very good yields. All the crops common to the region are grown, and in addition alfalfa is grown successfully in a few places. This soil is usually included in fields with the Union silt loam or Dodgeville silt loam, and the methods of farming are the same as on those types. Corn averages 40 bushels, oats 40 bushels, and hay 2 tons per acre. The methods of improvement required by the Dodgeville silt loam are applicable to this soil.

Genesee Series.

The Genesee series includes soils formed from dark-brown to grayish-brown alluvial sediments deposited along the major streams and their tributaries throughout the northeastern glaciated region, particularly where the Dunkirk, Volusia, Miami, and Ontario series constitute the principal upland soils. The soils of this series also occur for a short distance south of the glaciated area, where main streams have their headwaters in areas covered by these soil series. The sandy members of the series are prevailingly light brown to gray, and the loam and silt loam members darker brown. The soils of this series are subject to either annual or frequent overflow. The series is represented in Dane County by only one type, the Genesee fine sand.

GENESEE FINE SAND.

The surface soil of the Genesee fine sand consists of a light-brown, loose fine sand which contains only a very small quantity of organic matter. The subsoil is encountered at an average depth of about 8 inches. It is a yellowish fine sand of the same texture and structure as the soil and extends to a depth of over 3 feet.

There is considerable variation in color, texture, and depth of soil, largely on account of wind action which has influenced the surface to varying degrees. Low dunes have been formed, and on the crest of these the soil is very light, while in the sloughs and depressions the material is loamy and dark colored. Many areas of Peat, silt, sand, and gravel are encountered, but these are not of sufficient extent to be indicated on the soil map.

This soil covers only one-fifth square mile in Dane County, and it is confined to the northwestern section in the valley of the Wisconsin River.

The type is low and level, except for the undulations caused by wind action. The water table is quite close to the surface, and the type is subject to annual overflow.

The material forming the Genesee fine sand is of alluvial origin, having been transported mainly from the glacial region by the river and deposited in the present flood plain.

The forest growth consisted of swamp oak, sycamore, basswood, ash, elm, and soft maple. The merchantable timber has been removed, but the land has not been cleared.

On account of the floods but little use is made of this soil other than for pasturage and cutting a small quantity of wild hay. It is hardly prudent to attempt the cultivation of this soil without the construction of levees, and the expense of this would be much greater than would be justified by the agricultural value of the soil. The type is best used as pasture.

MISCELLANEOUS MATERIAL.

ROUGH STONY LAND.

The areas mapped as Rough stony land consist mainly of steep, rocky slopes and cliffs. They comprise land which is too steep and rocky to be cultivated. The covering of soil over the rocks is thin and often filled with rock fragments. The texture of the soil varies from a silt loam to a fine sand or fine sandy loam.

This type is practically confined to the unglaciated part of the county and is associated with the Union silt loam. It occupies the steepest portions of the valley walls throughout that region. The surface is always steep, and the natural drainage is excessive.

The outcropping rock consists of both sandstone and limestone, though the greater part is probably limestone. The soil is the result of weathering of these formations and includes wash from higher lying soils. Some of the silt present possibly is of loessial origin.

The forest growth on these steep slopes consists chiefly of oak and hickory. Much of this is still standing, though the best trees have been cut.

Rough stony land is nonagricultural and of value only for the small amount of pasturage it affords. Its only other possible use is for forestry, where there is sufficient soil mantle.

MADELAND.

Madeland includes poorly drained areas in and about the city of Madison, which have been filled in artificially. Originally the soil was Clyde silt loam, Muck or Peat. In most cases such tracts have been covered by pumping sand from adjoining lakes, but in some instances soil has been hauled from higher lying areas. It is quite common to cover the sand with a thin veneer of "clay."

The areas of Madeland are not used for agriculture, but are platted in small lots and sold as building sites.

PEAT.

The material mapped as Peat consists of black or dark-brown vegetable matter in varying stages of decomposition, with which there is incorporated a small percentage of mineral matter. It ranges in depth from 2 to about 20 feet, with an average of probably 5 feet. The greater part of the Peat is quite fibrous, though in a number of places it is fairly well decomposed and tenacious, so that it can be molded into different forms by the hands. When dry this well-decomposed Peat somewhat resembles a black carbonaceous clay. Where encountered in areas of sandy soils the underlying material is frequently sandy, while in regions of heavy upland soils the underlying material is clayey in character. Most of the areas of Peat are underlain by material as heavy as a loam or heavier. The largest areas underlain by sand occur in the valley of the Wisconsin River in the northwestern part of the county. In this region there are a few small sand "islands" in the Peat areas and in places the underlying sand is nearer the surface than usual. Practically all of the other large Peat marshes within the county are underlain by heavy material.

Peat is extensively developed in Dane County, and is widely distributed throughout the glaciated region. The largest areas occur in the northeastern part of the county in Burke, Sun Prairie, Medina, York, Deerfield, Cottage Grove, and Blooming Grove Town-

ships. Smaller areas are encountered in the southeastern, south-central, and extreme northwestern sections.

The Peat areas are low, level, and very poorly drained. During early spring some of the marshes are entirely covered with water, while later in the summer many tracts are dry enough and firm enough to bear the weight of farm animals, so that they can be pastured or cut for hay where there is a growth of wild grasses. The natural drainage courses have been deepened and large open ditches constructed in a number of the marshes, and a considerable part of this land is being reclaimed and transformed into producing fields.

The Peat has been formed through the growth and partial decomposition in the presence of water of a rank vegetation, the black or dark-colored material being formed largely from grasses and sedges, and that having a brown color chiefly from sphagnum moss. About the margin of the larger marshes, and over the greater part of the smaller ones, varying quantities of soil from the adjoining higher land have been washed in and incorporated with the vegetable matter. Wherever this is sufficient to change materially the texture and structure of the material it is separated and mapped as Muck. The Peat beds occupy old lake basins, ponded valleys, kettle basins, glacial sloughs, and other depressions in the uneven surface developed by the glacial ice sheet. Peat may also be found within the flood plain of many of the streams. Although the greater part of the Peat occurs within a region where the upland soils are made up in part of limestone material, some of it is in an acid condition. This is usually the case in the center of the larger marshes, while many of the smaller ones are not thus affected.

The native growth consists chiefly of several varieties of grasses, sedges, and some arrowhead, cat-tail, and various reeds and rushes. Some of the sphagnum-moss peat beds support a growth of tamarack, sumac, huckleberry, and some quaking aspen. Where the Peat is shallow, elm and ash are sometimes found.

A number of projects are under way for reclaiming the Peat areas. Where thoroughly drained and properly handled these marshes will greatly increase the total of good agricultural land within the county. The marshes are largely so situated that they can be drained by large open ditches, and later, when the land has settled sufficiently, tile drains may be installed as laterals leading into the ditches.

Peat is very rich in nitrogen, and the best practice is to use commercial fertilizers in preference to stable manure, which can be used to better advantage on the upland soils.

The most extensive use now made of this land is for cutting wild hay. One ton per acre is about the average yield. Some of the marshes are used for pasturage.

Where reclaimed the Peat areas are adapted to a wide range of crops. Corn, hay, oats, potatoes, onions, celery, cabbage, and peppermint are successfully grown on such land in other counties. Potatoes grown on Peat are not of as good quality as those grown on sandy soils, and small grain is likely to lodge and be of somewhat lower grade than where grown on upland soil.

The value of the Peat is variable. It is usually held in connection with the upland soils. The value of the Peat alone may be estimated at $10 to $25 per acre where unimproved, depending upon the location and the probable cost of drainage. Where properly reclaimed it is equal in producing capacity to the upland soils with which it is associated.

MUCK.

The material mapped as Muck consists of vegetable matter in varying stages of decomposition, with which there are incorporated large quantities of mineral matter. It may be considered as intermediate between Peat and the soils of the Clyde series. In some places the surface material is Peat, but is underlain at 10 to 14 inches by silt loam or silty clay loam, and such tracts can not well be classified with the true Peat.

Muck is not of large extent in this county, and it occurs only in small tracts scattered throughout the glaciated section. It occupies about the same topographic position as Peat, and is poorly drained and usually in a swampy condition. It is so situated that most of it could be drained along with the Peat. With drainage well established the material is very productive. In its present condition, however, its only value is for the pasturage it affords and the marsh hay which is cut from some areas.

MEADOW.

Meadow comprises first-bottom land subject to annual overflow. The texture is so variable that no satisfactory classification into established soil types can be made. In color the material varies from light brown to nearly black. The texture usually ranges from a fine to medium sand, but there are small patches where it is considerably heavier. In a few places there is a shallow covering of Peat. Meadow is of very limited extent, and is confined to the valley of the Wisconsin River in the extreme northwestern corner of the county. It occurs as a narrow belt, from one-eighth to one-fourth mile in width, immediately bordering the river, and it lies only a few feet above the level of the stream. The surface is nearly flat, the water table is close to the surface, and the natural drainage is usually deficient. A part of the Meadow land is swampy.

The material forming Meadow is of alluvial origin, and to it has been added varying quantities of organic matter through the growth and decay of grasses and other plants. The forest growth is scattered, and consists chiefly of soft maple, willow, and some elm and ash. The timber now standing has no value except for firewood. The Meadow has not been cleared and put under cultivation, but some of it is used for pasture. About the only agricultural uses to which it can be put are as pasture or hay land.

SUMMARY.

Dane County is located in the south-central part of Wisconsin, and comprises an area of 1,202 square miles, or 769,280 acres. The surface varies from level or gently undulating prairies and outwash plains to hilly and broken country. From the standpoints of physiography and geology the county falls naturally into two broad divisions—the driftless western part of the county, where the surface configuration is largely the result of erosion, and the remainder of the county, which has been greatly influenced by glacial action and has a more even topography.

The drainage of the northwestern part of Dane County is directly into the Wisconsin River. The remainder is drained through the Yahara and Sugar Rivers and their tributaries into the Rock River and thence into the Mississippi.

The first permanent settlements in Dane County were made about 1830. The first settlers were interested in mining, but agriculture soon developed, and the county is now one of the most highly improved in the State. Madison, the county seat and the capital of the State, is an important railroad center and has a population of 25,531, according to the 1910 census. The population of the county is reported as 77,435. The entire county is well supplied with transportation facilities, and all sections are well settled.

The climatic conditions in this part of Wisconsin are favorable for the development of general farming and dairying. The mean annual temperature at Madison is 45.7°, and the mean annual precipitation is 31.25 inches. On the average, during each of the months of May, June, July, August, and September, there is more than 3 inches of rainfall. The rainfall is usually fairly well distributed, but there are occasionally short periods of drought or of excessive rainfall.

The general type of agriculture in Dane County consists of general farming in conjunction with dairying. In 1913 there were 90 cheese factories and 50 creameries in the county. The common farm crops are corn, oats, barley, clover, timothy, alfalfa, wheat, and rye. In addition a number of special crops are grown, including tobacco, potatoes, peas, and sugar beets.

Some beef cattle are fed, chiefly in the tobacco-growing districts, but the raising of beef cattle is unimportant as compared with the dairy industry. Hog raising is carried on quite extensively, and a few sheep and horses are raised in the county.

Agriculture is highly developed in nearly all sections. Land values range from about $25 an acre in the sandy and rough areas, to $250 or even more an acre in the sections containing the most highly improved farms. In 1910 the average value was $72.73 an acre.

The geologic formations which form the surface rock in Dane County and have largely given rise to the soils are, in order of their occurrence, the Potsdam sandstone, Lower Magnesian limestone, St. Peters sandstone, and the Trenton and Galena limestone. The greater part of the county was traversed by two glacial ice sheets of different age. The older is known as the pre-Wisconsin glaciation, and its débris covers only a very small part of the county. The younger is known as the last Wisconsin glaciation, and material from this source covers over half of the county. In addition to these sources of material a mantle of loess has been deposited over most of the unglaciated section and over a part of the glaciated section.

In Dane County 14 soil series and 31 soil types, including Rough stony land, Madeland, Peat, Muck, and Meadow, are recognized.

The Carrington series consists of dark-colored, upland prairie, glaciated limestone material. Some of the highest priced farming land in the region is included in the silt loam and its deep phase. The fine sandy loam is not important. Most of this land is cultivated. General farming is the chief activity, with tobacco growing an important special industry.

The Miami series consists of light-colored, upland, forested, glaciated limestone material. The fine sandy loam and silt loam are extensive and valuable agricultural types, the former well suited to truck crops. The silt loam and its deep phase support chiefly general farming. The gravelly fine sandy loam is of small extent and mostly in pasture. The loam is also inextensive, but largely in cultivation.

The Rodman gravelly fine sandy loam includes light-colored assorted glacial material which occurs chiefly as kames and eskers. It has a low agricultural value, and is of small extent.

The Fox series includes light-colored, forested soils mainly in glaciated limestone regions where the material occupies outwash plains or stream terraces. The series in this county is not extensive, but the three types encountered are well improved.

The Plainfield series is represented by one type, the fine sand. It is an alluvial terrace soil derived from glacial débris. About half the type is cultivated and used for general farming. It has a rather low value.

The Waukesha series comprises dark-colored, prairie or semiprairie soils derived from reworked glacial material, deposited as outwash plains or terraces. It includes good agricultural land. The types mapped are the Waukesha fine sandy loam and silt loam.

The Clyde series is represented by three types, the fine sandy loam, loam, and silt loam. These are dark-colored soils within the glaciated limestone region, where the material is of alluvial or lacustrine origin and occurs as old lake beds, ponded valleys, or as first-bottom land along the streams. They are low and poorly drained, but well suited to crop production when drained, especially the silt loam, which can be made very productive.

The light-colored, forested upland soils of the unglaciated region, where the material is largely of loessial origin, are classed with the Union series. The Union silt loam is extensively developed and includes a large area of good farm land. It is mostly in cultivation to general farm crops. The steep phase is less valuable.

The Dodgeville series includes dark-colored, upland prairie soils of the unglaciated region, where the material has been derived largely from the loesslike mantle covering a part of the county. This series comprises good general farming land. The Dodgeville fine sandy loam and silt loam are recognized.

The Crawford silt loam is a dark-colored, upland prairie soil. The material is largely of residual origin from the underlying limestone. It constitutes good general farming land, but the soil is often shallow.

The La Crosse series is represented by one type, the silt loam. It is a dark-colored prairie or semiprairie soil within the driftless region, where it occurs as a terrace above overflow. The parent material is largely from the unglaciated region. This soil is of small extent in the present survey.

The Boone series includes light-colored forested soils where the material has been derived from the weathering of sandstone, in this county chiefly the St. Peters sandstone. The series is of rather low agricultural value. The types mapped are the Boone fine sandy loam and loam.

The Wabash loam and silt loam comprise dark-colored soils of the unglaciated region. The material is of alluvial origin and occurs as first-bottom land. The soils are poorly drained and subject to overflow. The land is largely not in cultivation.

The Genesee fine sand is a very inextensive light-colored soil which occurs as first-bottom land. The material is alluvial in origin and consists of reworked glacial débris. The land is subject to inundation.

Rough stony land comprises steep, rocky slopes where the slope is

too steep or the land too rocky to be of value for cultivated crops and is of use only for pasturage and forestry.

Madeland consists of small, poorly drained areas of filled-in material.

Peat consists of vegetable matter in various stages of decomposition, with which there are usually incorporated small quantities of mineral matter. In its present condition it is poorly drained and of little value. When drained and reclaimed it makes very valuable land. Peat is an extensive type in Dane County.

Muck includes highly organic soils intermediate between Peat and soils of the Clyde series. It is not extensive in Dane County.

Meadow includes first-bottom land subject to overflow, where the material is so variable that it can not be separated into recognized soil types. It is of very limited extent.

○

[PUBLIC RESOLUTION—No. 9.]

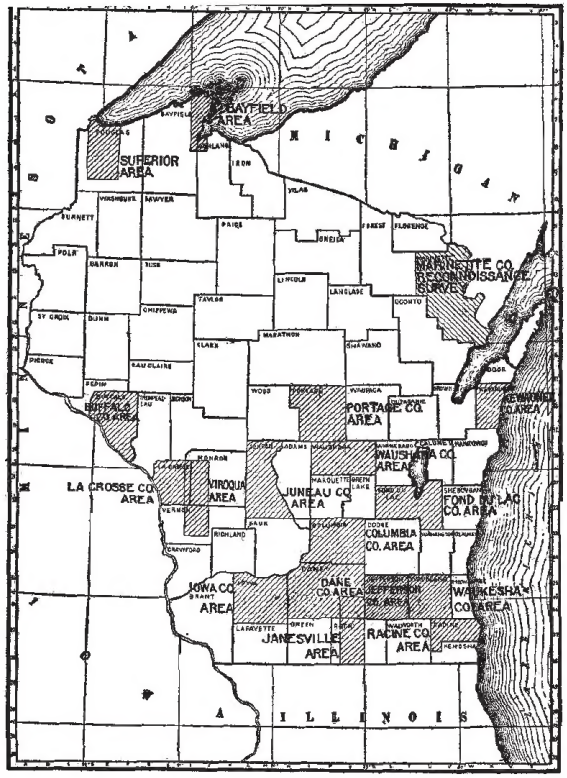
JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided*, That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the Congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved, March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils.]



Areas surveyed in Wisconsin.

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U.S. DEPT OF AGRICULTURE
BUREAU OF SOILS
MILTON WHITNEY, CHIEF
CURTIS F. MARBUT, IN CHARGE SOIL SURVEY

SOIL MAP
WISCONSIN
DANE COUNTY SHEET

STATE OF WISCONSIN
GEOLOGICAL AND NATURAL HISTORY SURVEY
E.A. BIRGE, DIRECTOR
COLLEGE OF AGRICULTURE, UNIVERSITY OF WISCONSIN,
H.L. RUSSELL, DEAN
A.R. WHITSON, IN CHARGE SOIL SURVEY

W.E. McLendon, Inspector Northern Division.
Soils surveyed by W.J. Geib and Aurthur E. Taylor
of the U.S. Department of Agriculture and Guy Conrey
of the Wisconsin Geological and Natural History Survey

BASE MAP IN PART FROM
U.S. GEOLOGICAL SURVEY SHEETS

Contour interval 20 feet.

Field Operations
Bureau of Soils
1913